An Overview of Neurosurgery and Its Techniques

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How to cite this Article: Rajput J,Singh S,An overview of Neurosurgery and its Tehniques. Arch CranOroFac Sc 2017;5(2):1-3
Source of Support: Nil.
Conflict of Interest: Nil.

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Article Code: ACOFS0050

INTRODUCTION

The prevention, diagnosis, surgical treatment, and rehabilitation of disorders affecting any part of the nervous system, including the brain, spinal cord, central and peripheral nervous systems, and cerebrovascular system, are the focus of the medical specialty known as neurosurgery or neurological surgery, sometimes referred to as brain surgery.(1)

Numerous ailments, including tumors, blood clots, aneurysms, epilepsy, and diseases relating to the spine, are treated using neurosurgery. It is carried out by a neurosurgeon and includes an anesthesiologist who is well-versed in the kinds of anesthetic, postoperative care, and monitoring needed for these delicate procedures.(1,2)

TECHNIQUES IN NEUROSURGERY

These are a few of the most popular neurosurgery procedures that involve the brain's spine or surrounding nerve system. (2) The following explanations are based in part on data from the National Cancer Institute.

BIOPSY:- A biopsy is the process of taking a little sample of aberrant tissue from the body so that a pathologist can study it under a microscope. In order to access the brain and remove a sample of brain tissue or a tumor, the surgeon may make a cut on the scalp and remove a portion of the skull bone in order to execute this procedure on or near the brain. In a less invasive biopsy, the surgeon removes a sample of tumor or brain cells by drilling a tiny hole in the skull and inserting a thin, hollow needle.

CRANIOTOMY: In order to treat other brain disorders, alleviate pressure following an injury or stroke, repair a brain aneurysm or skull fracture, remove a brain tumor, abnormal tissue, blood, or blood clots, or relieve pressure after an injury or stroke, a portion of the skull is removed to allow surgeons access to the brain. Following surgery, the fragment of the skull is reinserted.

DBS (DEEP BRAIN STIMULATION): An implantable pulse generator is a medical device that runs on batteries and is used to stimulate certain parts of the brain with electricity. The most prevalent conditions for which DBS is utilized are seizure disorders, Parkinson's disease, and other movement disorders.

NEUROENDOSCOPY: In order to access or remove brain tissue with this minimally invasive procedure, a thin tube known as an endoscope is inserted through the mouth, nose, or tiny incisions in the skull. Tools are inserted through the endoscope to do the surgery, and the endoscope itself contains a light and camera on the end. One kind of neuroendoscopy is endoscopic transsphenoidal surgery, commonly known as endoscopic pituitary surgery.(3) To remove brain tumors and lesions close to the pituitary gland, just behind the nose bridge, an endoscope is inserted via the nose.

DECOMPRESSION OF THE POSTERIOR FOSSA: This procedure is done to lessen the strain on the spinal cord and brain. It is used to treat disorders that compress the brain stem and cerebellum, such as Chiari malformation. To remove a tiny piece of bone at the base of the skull, the surgeon creates an incision at the back of the patient's head. This removal lowers strain on the spinal cord and makes more room for the brain stem and cerebellum.

THROMBECTOMY: A thrombectomy is most frequently performed on patients who have a cerebral aneurysm (a weak and protruding section of an arterial wall), a blood clot in a brain artery, or a burst aneurysm that is causing bleeding into the brain. Using contrast dye to locate the affected blood vessel without opening the skull, the surgeon inserts surgical tools, such as a catheter or small metal wires, via a big blood vessel in the patient's groin to reach the brain vessels. The clot is then removed by the surgeon using a tool like an aspiration catheter or stent retriever. By rapidly reestablishing normal blood flow, thrombectomy can occasionally dramatically lower the risk of brain injury.(4)

DECOMPRESSION OF THE POSTERIOR FOSSA: The purpose of this procedure is to relieve pressure on the spinal cord and cerebellum. It is used to treat disorders that compress the brain stem and cerebellum, such as Chiari malformation. To remove a tiny piece of bone at the base of the skull, the surgeon creates an incision at the back of the patient's head. This removal lowers strain on the spinal cord and makes more room for the brain stem and cerebellum. Some brain cancer patients are treated with stereotactic surgery. (5) This is not a surgery in the common understanding of the term, because no incision is involved. Stereotactic surgery is an external radiation treatment that uses special equipment to deliver a high dose of radiation that precisely targets tumors or other lesions. This targeting minimizes damage to

surrounding healthy tissue.Neuroradiology techniques are used in contemporary neurosurgery to diagnose and treat patients. Examples of computer assisted imaging include stereotactic radiosurgery, Positron Emission Tomography (PET), Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and Magneto Encephalogram (MEG). Numerous neurosurgery techniques make use of intraoperative and functional magnetic resonance imaging.To access the brain during traditional open surgery, the neurosurgeon makes a large hole in the skull. Nowadays, endoscopes and microscopes are used in procedures requiring narrower apertures. High-resolution microscopic imaging of brain tissue combined with small craniotomies yields exceptional outcomes. Conversely, open techniques are still frequently used in emergency situations and trauma situations.

Microsurgery is employed in a number of neurological surgery procedures. Microvascular methods are used in restorative carotid endarterectomy and EC-IC bypass surgery. The process of cutting aneurysms is done under a microscope. Minimally invasive spine surgery involves the use of endoscopes or microscopes. Artificial disc replacement, laminectomy, and microdiscectomy are among the operations that involve microsurgery. (6)

Stereotaxy is a technique used by neurosurgeons to reach a small target through a tiny opening in the brain. This is used in functional neurosurgery, such as when implanting electrodes or accurately administering gene therapy in cases of Parkinson's or Alzheimer's disease.(5) It may be possible to effectively remove intraventricularhemorrhages by combining open and stereotactic surgery.

Traditional surgery with image guiding technologies is referred to as guided surgery, stereotactic navigation, computer-assisted surgery, or surgical navigation. (7) Similar to a car or mobile Global Positioning System (GPS), image-guided surgery systems, like Curve Image Guided Surgery and Stealth Station, use cameras or electromagnetic fields to record and transmit the patient's anatomy and the surgeon's precise movements in relation to the patient to computer monitors in the operating room.(8)Both before and during surgery, the surgeon can use these potent electronic gadgets to help orient them with three-dimensional pictures of the patient's anatomy, including the tumor.

Using electrocorticography, real-time functional brain mapping has been used to pinpoint particular functional areas.When appropriate, neurosurgeons often perform minimally invasive endoscopic surgery. Treatment options for endoscopic endonasal surgery include chordomas, pituitary tumors, craniopharyngiomas, and the closure of CSF fluid leaks. Ventricular endoscopy is used to treat intraventricularhemorrhage, hydrocephalus, colloid cysts, and neurocysticercosis. Sometimes, neurosurgeons and ENT surgeons work together to perform endonasal endoscopy. Neurosurgeons occasionally work in conjunction with maxillofacial and plastic surgeons to address disorders of the craniofacial region and abnormalities in the circulation of cerebrospinal fluid.

Neurosurgeons and radiation oncologists work together to employ stereotactic radiosurgery to treat tumors and AVMs. Novalis, Cyberknife, and Gamma knife Among the radiosurgical techniques used is radiosurgery. (9) In the field of endovascular surgical neuroradiology, endovascular image guided procedures are used to treat aneurysms, AVMs, carotid stenosis, strokes, spinal anomalies, and vasospasms. (8,9)Angioplasty, stenting, clot retrieval, embolization, and diagnostic angiography are examples of endovascular operations. A common procedure in neurosurgery is the installation of a Ventriculo-Peritoneal shunt (VP shunt). This is frequently used to treat congenital hydrocephalus in children. The most common reason for this operation in adults is normal pressure hydrocephalus.

MODERNIZATION AND FUTURE OF NEUROSURGERY

The so-called new century neurosurgeon or modernized neurosurgeon of today will need to combine the artificial intelligence, advance medical engineering, latest developments in genetics and molecular biology with information technology. Until major diseases are addressed by molecular and genetic targeted treatments, surgery is more likely to become minimally invasive with advance microscopes, exoscopes and neuroendoscopes. Clinical neurology will still play a significant role in surgical decision-making, but technology will help improve methods and attain accuracy and excellence. Neurologists, psychiatrists, neuro-radiologists, and basic scientists are among the specialists that neurosurgeons will need to collaborate with. For instance, neurosurgeons, epileptologists, neuro-psychologists, and psychiatrists work closely together during epilepsy surgery. The neurosurgeon must therefore be a front player and a team monitor with great responsibility.

Without protest, they will have to take ownership of their own and the team's conduct. Since the majority of neurosurgical disorders now have multimodal therapies, they must be flexible enough to accommodate suggestions. They must always be patient and persistent, as these traits will enable them to get through challenging circumstances. Since digital technology will be used in future consultations and operational surgery, they must be proficient in computational neurobiology and telemedicine. They ought to be well-versed in humanity and bioethics. They should be well-versed in neuro-anatomy and physiology and have a passion for the topic based on scientific research.

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