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Teaching support material: Diagnostic procedures of the nervous system

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ABSTRACT
Diagnostic procedures are vital tools that help doctors confirm or rule out the presence of a neurological disorder or other disease. Scientific Problem: Insufficient bibliographies, most of which are obsolete Motivation: The dizzying development of technology is not yet within the reach of all students. Material: Data were collected from scattered bibliographies and compiled. Method: analysis and synthesis, once the procedures have been studied, it is possible to synthesize them for a better understanding of the students. Objective: To provide support material to students as a bibliography in programs that require it.

Keywords: Collection, Teaching, Procedures, Diagnostics, System, Nervous.

1 INTRODUCTION

Diagnostic tests and procedures are vital tools that help doctors confirm or rule out the presence of a neurological disorder or other disease. A century ago, the only way to make the positive diagnosis of many neurological disorders was to perform an autopsy after the patient's death. But decades of basic research into the characteristics of disease, and the development of techniques that allow scientists to see inside the human brain and monitor nervous system activity as it occurs, has given doctors precise and powerful tools for diagnosing diseases and for studying how well a particular therapy is working.

Perhaps the most significant changes in diagnostic imaging over the past 20 years are advances in the spatial resolution (size, intensity, and clarity) of anatomical images and reductions in the time needed to send signals and receive data from the area from which the image is obtained. These advances allow doctors to simultaneously see brain structure and changes in brain activity as they occur. Scientists continue to improve methods that will provide sharper anatomical images and more detailed functional information.

Researchers and clinicians use a variety of diagnostic imaging techniques and chemical and metabolic analyses to detect, monitor, and treat neurological disease. Some procedures are performed

in special settings, performed to determine the presence of a particular disorder or abnormality. Many tests that were once done in a hospital are now done in a doctor's office or outpatient testing center, with little to no risk to the patient. Depending on the type of procedure, the results are immediate or may take several hours to process.

The nursing staff plays a fundamental role in the performance of these procedures since most of them need the correct actions that they perform.

The authors searched for information through the network due to the need to prepare themselves in these topics in the Clinical Surgical subject taught to nurses, as these are very dispersed and some of them constitute novel diagnostic means. **Objective: To** disseminate the support material of diagnostic procedures of the nervous system to the students as a bibliography in the programs that require it.

2 DEVELOPMENT

The brain is the most important part of the nervous system, the largest part of the brain, and controls thought. Learning, emotions, memory, speech, reading, writing, and voluntary movements1.

Among the diseases that affect the nervous system, there are; vascular disorders in the brain; arteriovenous malformations and brain aneurysm; tumors, benign and malignant (cancer). Degenerative diseases, including Alzheimer's disease and Parkinson's disease, Pituitary disorders, Epilepsy, headaches. Even migraine2.

3 THE MOST COMMON ASSESSMENT TESTS

Laboratory ***evaluation tests*** of blood, urine, or other substances are used to help diagnose disease, better understand the disease process, and monitor levels of therapeutic medications. Certain tests, ordered by the doctor as part of a regular checkup, provide general information, while others are used to identify specific health concerns. For example, blood tests and blood products can detect brain and spinal cord infections, bone marrow diseases, bleeding, blood vessel damage, toxins that affect the nervous system, and the presence of antibodies that signal the presence of an autoimmune disease. Blood tests are also used to monitor the levels of therapeutic drugs used to treat epilepsy and other neurological disorders. Genetic testing of DNA extracted from white blood cells can help diagnose Huntington's disease and other congenital diseases. Analysis of the fluid surrounding the brain and spinal cord can detect meningitis, acute or chronic inflammation, rare infections, and some cases of multiple sclerosis. Blood chemistry and metabolic tests can indicate protein disorders, some forms of muscular dystrophy and other muscle disorders, and diabetes. Urinalysis may reveal abnormal substances in the urine or the presence or absence of certain disease-causing proteins, including mucopolysaccharidoses.

Genetic testing or counseling can help parents who have a family history of a neurological disease determine if they carry one of the known genes that causes the disorder or find out if their child is affected. Genetic testing can identify many neurological disorders, such as spina bifida in the womb (while the baby is inside the mother's womb). Genetic testing includes:

Amniocentesis, usually performed at 14-16 weeks of pregnancy, examines a sample of amniotic fluid from the uterus for genetic defects (the fluid and fetus have the same DNA). Under local anesthesia, a thin needle is inserted through the woman's abdomen into the uterus. About 20 milliliters of liquid (about 4 teaspoons) are removed and sent to the lab for evaluation. Test results often take 1-2 weeks.

Chorionic hair sampling is done by removing and examining a small sample of the placenta during early pregnancy. The sample, which contains the same DNA as the fetus, is removed with a catheter or thin needle inserted through the cervix or with a thin needle inserted through the abdomen. It is screened for genetic abnormalities and results are usually available within 2 weeks. Sampling should not be done after the tenth week of pregnancy.

Uterine ultrasound, which is done using a surface probe with gel. This non-invasive test may suggest the diagnosis of diseases such as chromosomal disorders (see ultrasound imaging, below).

3.1 WHAT IS A NEUROLOGICAL EXAM?

A ***neurological exam*** evaluates motor and sensory skills, the functioning of one or more cranial nerves, hearing and speech, vision, coordination and balance, mental status, and changes in mood and behavior, among others. Items such as a tuning fork, flashlight, reflex hammer, ophthalmoscope, and needles are used to help diagnose brain tumors, infections such as encephalitis and meningitis, and diseases such as Parkinson's, Huntington's disease, amyotrophic lateral sclerosis, and epilepsy. Some tests require the services of a specialist to perform them and analyze the results.

X-rays of the patient's chest and skull ***are often taken*** as part of a neurological study. X-rays can be used to view any part of the body, such as a joint or major organ system. In a conventional X-ray, a technician passes a concentrated burst of a low dose of ionized radiation through the body and onto a photographic plate. Because calcium in bones absorbs X-rays more easily than soft tissue or muscle, the bone structure appears white on film. Any misalignment or fracture can be seen within minutes. Tissue masses such as injured ligaments or a protruding disc are not visible on conventional x-rays. This quick, non-invasive, and painless procedure is usually performed in a doctor's office or clinic.

Fluoroscopy is a type of x-ray that uses a continuous or pulsed beam of low-dose radiation to produce continuous images of a moving part of the body. The fluoroscope (X-ray tube) is focused on the area of interest and the images are recorded on video or sent to a monitor for viewing. A contrast

dye may be used to enhance the images. Fluoroscopy can be used to evaluate blood flow through the arteries.

3.2 WHAT ARE SOME DIAGNOSTIC TESTS USED TO DIAGNOSE NEUROLOGICAL DISORDERS?

- Based on the result of the neurological examination, physical examination, patient history, chest and skull x-rays, and previous tests and evaluations, physicians may order one or more of the following diagnostic tests to determine the specific nature of a suspected neurological injury or disorder. These tests usually involve *nuclear medicine* imaging, in which very small amounts of radioactive materials are used to study organ function and structure, or *diagnostic imaging*, which uses magnets and electrical changes to study human anatomy.
- The following list of available procedures, in alphabetical rather than sequential order, comprises some of the most common tests used to help diagnose a neurological condition.
- ***Angiography*** is a test used to detect blockages in the arteries or veins. A *cerebral angiogram* can detect the degree of narrowing or blockage of an artery or blood vessel in the brain, head, or neck.
- It is used to diagnose strokes and to determine the location and size of a brain tumor, aneurysm, or vascular malformation. This test is usually done in an outpatient hospital and takes up to 3 hours, followed by a 6- to 8-hour rest period. The patient, dressed in a hospital gown, lies on a rolling table that is pushed into the imaging area. Although the patient is awake, the doctor anesthetizes a small area of the leg near the groin and inserts a catheter into a main artery located there. The catheter is passed through the body and into an artery in the neck. Once the catheter is in place, the needle is removed and a guide wire is inserted. A small capsule containing a radiopaque dye (one highlighted on x-rays) is passed over the guide wire to the release site. The dye is released and travels through the bloodstream to the head and neck. A series of x-rays are taken and any blockages are noted. Patients may feel a warm to warm sensation or mild discomfort when the dye is released.
- A ***biopsy*** involves the removal and examination of a small piece of tissue in the body. Muscle *and nerve biopsies* are used to diagnose neuromuscular disorders and can also reveal if a person carries an abnormal gene that can be passed on to children. A small sample of muscle and nerve is removed under local anesthesia and studied under the microscope. The sample can be removed surgically, through a slit in the skin, or by needle biopsy, in which a thin hollow needle is inserted through the skin into the muscle. A small

piece of muscle or nerve remains in the hollow needle when it is removed from the body. The biopsy is usually done in an outpatient testing center. A brain *biopsy*, used to determine the type of tumor, requires surgery to remove a small piece of the brain or tumor. Performed in a hospital, this operation is riskier than a muscle biopsy and involves a longer recovery period

- Brain ***ultrasounds*** are imaging techniques used to diagnose tumors, blood vessel malformations, or brain hemorrhages. These ultrasounds are used to study organ function, an injury or disease of tissue or muscle. Types of brain ultrasound include computed tomography, magnetic resonance imaging, and positron emission tomography (see descriptions below).
- ***Cerebrospinal fluid analysis*** involves removing a small amount of fluid that protects the brain and spinal cord. The fluid is examined for bleeding or bleeding in the brain, diagnosing a brain or spinal cord infection, identifying some cases of multiple sclerosis and other neurological conditions, and measuring intracranial pressure.
- The procedure is usually done in a hospital. Commonly, the fluid sample is removed with a procedure known as a *lumbar puncture* . The patient is asked to lie on their side, in a ball position with their knees next to their chest, or to lean forward on a table or bed. The doctor will locate a puncture site in the lumbar spine, between two vertebrae, then clean the area and inject a local anesthetic. The patient may feel a pricking sensation from this injection. Once the anesthetic takes effect, the doctor will insert a special needle into the spinal sac and remove a small amount of fluid (usually about three teaspoons) for testing. Most patients will feel a pressure sensation only when the needle is inserted.
- A common after-effect of lumbar puncture is headache, which can subside by causing the patient to lie down. There may be a risk of injury or infection to the nerve root from the puncture, but it is rare. The entire procedure takes about 45 minutes.
- Computed ***tomography***, also known as CT, is a painless, noninvasive process used to produce fast, clear, two-dimensional images of organs, bones, and tissues. A neurological CT scan is used to look at the brain and spinal cord. It can detect bone and vascular irregularities, certain brain tumors and cysts, herniated discs, epilepsy, encephalitis, spinal stenosis (narrowing of the spinal canal), a blood clot, or intracranial bleeding in patients with stroke, brain damage from a head injury, or other disorders. Many neurological disorders share certain characteristics and a CT scan can help make the correct diagnosis by differentiating the area of the brain affected by the disorder.
- The scan takes about 20 minutes (a brain or cranial CT ultrasound may take a little longer) and is usually done in an imaging center or hospital on an outpatient basis. The patient lies

on a special table that slides into a narrow chamber. A sound system built into the chamber allows the patient to communicate with the doctor or technician. While the patient remains still, X-rays pass through the body at various angles and are detected by a computerized scanner. The data is processed and displayed in cross-sectional images, or "slices," of the internal structure of the body or organ. A mild sedative may be given to patients who are unable to sit still and pillows may be used to support and stabilize the head and body. Claustrophobic people may have a hard time getting this picture test.

- Sometimes a contrast dye is injected into the bloodstream to highlight the different tissues in the brain. Patients may feel a warm or cool sensation as the dye circulates through the bloodstream or feel a mild metallic taste.
- Although very little radiation is used in CT scans, pregnant women should avoid the test because of the potential harm to the fetus from ionized radiation.
- Discography is often suggested for patients who are considering lumbar surgery or whose low back pain has not responded to conventional treatments. This outpatient procedure is usually done at a testing center or hospital. The patient is asked to put on a metal-free hospital gown and lie on an imaging table. The doctor anesthetizes the skin and inserts a thin needle, using X-ray guidance, into the spinal disc. Once the needle is in place, a small amount of contrast dye is injected and the CT test is done. The contrast dye outlines the damaged areas. Images of more than one disc can be taken at the same time. Generally, the patient's recovery takes about an hour. Painkillers may be prescribed for the resulting discomfort.
- A ***CT ultrasound highlighted with ultra Tecal contrast*** (also called cisternography) is used to check for problems in the spine and spinal nerve roots. This test is usually done in an imaging center. The patient is asked to change into a hospital gown. After applying a topical anesthetic, the doctor removes a small sample of spinal fluid through a lumbar puncture. The sample is mixed with a contrast dye and injected into the spinal sac located at the base of the lumbar spine. The patient is then asked to move into a position that allows the contrast liquid to travel to the area to be studied. The dye allows the spinal canal and nerve roots to be seen more clearly on a CT scan. The test takes up to an hour to complete. After the test, patients may have some discomfort or headache that may be due to the removal of the spinal fluid.
- ***Electroencephalography***, or EEG, monitors brain activity through the skull. EEG is used to help diagnose certain seizure disorders, brain tumors, brain damage from head injuries, brain or spinal cord inflammation, alcoholism, certain psychiatric disorders, and metabolic and degenerative disorders that affect the brain. EEGs are also used to assess sleep

disturbances, monitor brain activity when a patient is fully anesthetized or loses consciousness, and confirm brain death.

- This painless and risk-free test can be done in a doctor's office, hospital, or testing center. Before undergoing an EEG, the person should avoid caffeine intake and prescription medications that affect the nervous system. A series of cup-like electrodes are attached to the patient's scalp, by means of a special conductive paste or with extremely fine needles. Electrodes are small devices attached to wires that carry electrical energy from the brain to a machine for reading. A very low electrical current is sent through the electrodes and the basal brain energy is recorded. Patients are then exposed to a variety of external stimuli, including bright or flashing lights, noises, or certain medications, or asked to open and close their eyes, or to change their breathing pattern. The electrodes transmit the resulting changes in brainwave patterns. Because movement and nervousness can change brainwave patterns, patients usually recline on a chair or bed during the test, which takes up to an hour. The study of some disorders requires doing the EEG during sleep, which lasts at least 3 hours.
- In order to learn more about brainwave activity, electrodes can be inserted through a surgical opening into the skull and into the brain to reduce signal interference from the skull.
- ***Electromyography***, or EMG, is used to diagnose muscle and nerve dysfunctions and diseases of the spinal cord. It records electrical activity from the brain and spinal cord to a peripheral nerve root (found in the arms and legs) that controls muscles during contraction and at rest.
- During an EMG, very thin wire electrodes are inserted into a muscle to evaluate changes in electrical voltage that occur during movement and when the muscle is at rest. The electrodes are attached by a series of wires to a recording instrument. Tests are usually done at a testing center and last about an hour but can last longer, depending on the number of muscles and nerves to be studied. Most patients find this test somewhat uncomfortable.
- The recording is usually done from EMG needles along with a ***nerve conduction velocity (VCN)*** test, which measures electrical energy by assessing the nerve's ability to send a signal. This two-part test is most commonly performed in a hospital. A technician glues two sets of flat electrodes into the skin over the muscles. The first set of electrodes is used to send small pulses of electricity (similar to the sensation of static electricity) to stimulate the nerve that directs a particular muscle. The second set of electrodes transmits the electrical signal in response to a recorder. The doctor then reviews the response to check for nerve damage or muscle disease.

Nursing Care in Electromyography

- Advise patients preparing for this EMG or NCV test to avoid caffeine and not smoke for 2 to 3 hours before the test, as well as avoid aspirin and nonsteroidal anti-inflammatory drugs for 24 hours before EMG.
- If it is very cold outside, you are advised to wait in a warm room for a while before having the test3.
- There is no discomfort or risk associated with this test
- Tell the professional performing the test if you have a cardiac defibrillator or pacemaker or other implanted device, such as a deep brain stimulator,
- Do not put perfume, lotions, sunscreen, or moisturizers on your skin on the day of the test.

➢ ***Electronystagmography*** (ENG) describes a group of tests used to diagnose involuntary eye movements, dizziness, and balance disorders, and to evaluate some brain functions. The test is done in an imaging center. Small electrodes are glued around the eyes to record eye movements. If infrared photography is used instead of electrodes, the patient wears special goggles that help record the information. Both versions of the trial are painless and risk-free.

➢ Evoked ***potentials*** (also called evoked response) measure electrical signals to the brain generated by hearing, touch, or sight. These tests are used to evaluate sensory nerve problems and confirm neurological conditions such as multiple sclerosis, brain tumors, acoustic neuromas (small tumors of the inner ear), and spinal cord injuries. Evoked potentials are also used to examine vision and hearing (especially in infants and young children), monitor brain activity among coma patients, and confirm brain death.

➢ The test can be done in a doctor's office or hospital setting. It is painless and risk-free. Two sets of electrode needles are used to examine nerve damage. A set of electrodes, which will be used to measure the electrophysiological response to stimuli, is attached to the patient's scalp using a conductive paste. The second set of electrodes is attached to the part of the body to be studied. The doctor then records the amount of time it takes for the stimulus-generated impulse to reach the brain. Under normal circumstances, the signal transmission process is instantaneous.

➢ Auditory *evoked potentials* (also called auditory brainstem evoked response) are used to evaluate high-frequency hearing loss, to diagnose damage to the acoustic nerve and auditory pathways in the brainstem, and to detect acoustic neuromas. The patient sits in a soundproof room and puts on headphones. One popping sound at a time is sent to one ear while a masked sound is sent to the other ear. Each ear is usually examined twice, and the entire procedure takes about 45 minutes.

- Visual *evoked potentials* detect vision loss due to optic nerve damage (in particular, damage caused by multiple sclerosis). The patient sits near a screen and is asked to focus on the center of a movable chessboard pattern. Only one eye is examined at a time; The other eye is kept closed or covered with a patch. Each eye is usually examined twice. The test takes 30 to 45 minutes.
- *Somatosensory evoked potentials* measure the response of stimuli to peripheral nerves and can detect nerve or spinal cord damage or nerve degeneration from multiple sclerosis and other degenerative diseases. Small electrical impulses are sent through electrodes to a nerve in the arm or leg. Impulse responses, which can be sent for more than a minute at a time, are recorded. This test usually takes less than an hour.
- Magnetic ***resonance imaging*** (MRI) uses computer-generated radio waves and a powerful magnetic field to produce detailed images of body structures such as tissues, organs, bones, and nerves. Neurological uses include the diagnosis of brain and spinal cord tumors, eye diseases, inflammation, infection, and vascular irregularities that can lead to stroke. MRI scans can also detect and monitor degenerative disorders such as multiple sclerosis and can document brain injuries due to trauma.
- The device houses a hollow tube surrounded by a very large cylindrical magnet. The patient, who must remain still during the test, lies on a special table that slides into the tube. The patient will be asked to remove jewelry, eyeglasses, removable dentures, or other items that may interfere with the magnetic imaging. The patient should wear a sweatshirt and gym pants or other clothing without metal eyelets or buckles. MRI equipment creates a magnetic field around the body that is strong enough to temporarily realign water molecules in tissues. The radio waves are then passed through the body to detect the "relaxation" of the molecules back into a random alignment and trigger a resonance signal at different angles within the body. A computer processes this resonance into a three-dimensional image or a two-dimensional "slice" of the tissue to be explored, and makes the difference between bones, soft tissues, and fluid-filled spaces by their aqueous content and structural properties. A contrast dye may be used to highlight the visibility of certain areas or tissues. The patient may hear squeaking noises or knocking noises when the magnetic field is turned on and off (Patients may wear special hearing aids to block out sounds.) Unlike CT scans, MRI does not use ionized radiation to produce images. Depending on the body part(s) being scanned, it can take up to an hour to complete the MRI. The test is painless and risk-free, although obese or claustrophobic people may find it somewhat uncomfortable. (Some centers also use open MRI machines that do not completely surround the person being studied and are less confined. However, open MRI

does not currently provide the same image quality as standard MRI, and some tests may not be available using this equipment.) Due to the incredibly strong magnetic field generated by MRI, patients with implanted medical devices

- Functional *MRI* (FIRM) uses the magnetic properties of the blood to produce real-time images of blood flow to particular areas of the brain. An fMRI can pinpoint areas of the brain that are activated and note how long they remain active. It can also tell whether brain activity within a region occurs simultaneously or sequentially. The imaging process is used to evaluate brain damage from head injuries or degenerative disorders such as Alzheimer's disease and to identify and monitor other neurological disorders, such as multiple sclerosis, stroke, and brain tumors. Like a pacemaker, they should avoid the test.
- ***Myelography*** involves injecting a water- or oil-based contrast dye into the spinal canal to highlight the radiographic image of the spine. *Myelograms* are used to diagnose spinal nerve injuries, herniated discs, fractures, back or leg pain, and spinal tumors.
- The procedure takes about 30 minutes and is usually done in a hospital. After anesthesia is injected into a site between two vertebrae in the lumbar spine, a small amount of cerebrospinal fluid is removed by lumbar puncture (see *cerebrospinal fluid analysis*, above) and contrast dye is injected into the spinal canal. After a series of x-rays are taken, much or all of the dye is removed by aspiration. Patients may have some pain during the lumbar puncture and when the dye is injected and removed. They may also have a headache after the procedure. The risk of fluid leakage or allergic reactions from the dye is slight.
- Positron ***emission tomography*** (PET) provides two- and three-dimensional images of brain activity by measuring radioactive isotopes that are injected into the bloodstream. Brain PET scans are used to detect or highlight tumors and diseased tissues, measure cellular and tissue metabolism, show blood flow, evaluate patients with seizure disorders that do not respond to medical therapy and patients with certain memory disorders, and determine brain changes following injury or drug abuse. among others. PET scans may be indicated as a follow-up to a CT or MRI scan to give the doctor a better understanding of specific brain areas that may be involved in certain problems. CT scans are done on an outpatient basis in a hospital or testing center. A low-level radioactive isotope, which binds to chemicals flowing to the brain, is injected into the bloodstream and can be tracked as the brain performs different functions. The patient remains still while sensors above detect gamma rays in the body's tissues. A computer processes the information and displays it on a video monitor or on film. Using different compounds, more than one brain function can be tracked simultaneously. PET is painless and relatively risk-free. The length of the test

time depends on the part of the body being studied. PET scans are performed by trained technicians in highly sophisticated medical facilities.

- A ***polysomnogram*** measures body and brain activity during sleep. It is performed in a sleep center on one or more nights. The electrodes are glued or taped to the patient's scalp, eyelids, or chin. During the night and during the various wake-up and sleep cycles, the electrodes record brain waves, eye movements, breathing, skeletal and leg muscle activity, blood pressure, and heart rate. The patient can videotape themselves to notice movements during sleep. The results are then used to identify characteristic patterns of sleep disorders, including restless leg syndrome, periodic limb movement disorder, insomnia, and breathing disorders such as obstructive sleep apnea. Polysomnograms are painless, non-invasive, and risk-free.
- ***Single-photon emission computed tomography*** (SPECT), a nuclear imaging test that involves blood flow to tissues, is used to evaluate certain brain functions. The test may be indicated as a follow-up to an MRI to diagnose tumors, infections, degenerative spinal disease, and stress fractures. As with PET scanning, a radioactive isotope, which binds to chemicals flowing to the brain, is injected into the body intravenously. Areas of increased blood flow will collect more isotope. As the patient lies on a table, a gamma camera rotates around the head and records where the radioisotope has traveled. That information is computer-converted into cross-sectional slices that are stacked to produce a detailed three-dimensional picture of blood flow and brain activity. The test is done in an imaging center or hospital.
- Thermography uses infrared arresting devices to measure small changes in temperature between two sides of the body or within a specific organ. Also known as digital infrared thermal imaging, thermography can be used to detect vascular diseases of the head or neck, soft tissue injuries, various neuromusculoskeletal disorders, and the presence or absence of nerve root compression. It is done in an imaging center, using infrared light recorders to take thousands of images of the body from a distance of 5 to 8 feet. The information is converted into electrical signals that create a computer-generated, two-dimensional image of abnormally cold or hot areas indicated by color or shades of black and white. Thermography does not use radiation and is safe, safe, and non-invasive.
- Ultrasonic ***imaging***, also called ultrasound or sonography, uses high-frequency sound waves to obtain images inside the body. *Neurosonography* (ultrasound of the brain and spinal column) looks at cerebral blood flow and can diagnose strokes, brain tumors, hydrocephalus (cerebrospinal fluid buildup in the brain), and vascular problems. It can also identify or rule out inflammatory processes that cause pain. It is more effective than

an X-ray at showing masses in the soft tissue and can show tears in ligaments, muscles, tendons, and other masses in the soft tissue of the back. *Transcranial Doppler ultrasound* is used to view arteries and blood vessels in the neck and to determine blood flow and stroke risk.

- During the ultrasound, the patient lies on an imaging table, removing clothing near the area of the body to be examined. A jelly-like lubricant is applied and a transducer is passed through the body, which sends and receives high-frequency sound waves. The echoes of the sound waves are recorded and displayed as a real-time computer-generated visual image of the structure or tissue being examined. Ultrasound is painless, non-invasive, and risk-free. The test is performed on an outpatient basis and takes 15 to 30 minutes to complete.

4 NURSING ACTIONS IN THE VARIOUS TESTS BEFORE, DURING AND AFTER BEING PERFORMED

4.1 LUMBAR PUNCTURE

Lumbar or spinal puncture is a procedure whose goal is to ... their pressure and introduce drugs for DIAGNOSTIC and/or therapeutic purposes. 3-step wrench . ... conveying emotional support BEFORE, during, and AFTER. ... supine for at least 4 hours AFTER THE TEST, without a pillow.

4.2 THE INTERVENTION BY NURSING DURING THE TECHNIQUE CONSISTS OF:

1. Explain to the patient the purpose of the exam to gain their cooperation, conveying emotional support before, during, and after.
2. Check that you have signed the informed consent.
3. Ask the patient if he or she is allergic to any antiseptic and/or anesthetic.
4. Watch for neurological changes and check your vital signs.
5. Place the patient in the right or left lateral decubitus position on the edge of the bed and in the fetal position. Such posture is a must for dynamic testing.
6. Keep the patient immobilized during the test, transmitting security at all times, to avoid complications.
7. Proceed to place the sterile field.
8. Maintain asepsis throughout the process.
9. Open lumbar puncture device.
10. Collaborate with the doctor performing the procedure. Collect and label the tubes.
11. Put a sterile dressing over the puncture site.

12. Keep the patient supine for at least 4 hours after the test, without being able to consume food or liquids.
13. Observe the appearance of inflammation or bleeding at the puncture site.
14. Check for neurological signs and check your vital signs and other alterations that may appear after the exam (headaches, vomiting and dizziness).

5 MAGNETIC RESONANCE IMAGING (MRI)

Magnetic **resonance imaging** (MRI) is a noninvasive medical exam that helps doctors diagnose and treat diseases. MRI uses a strong magnetic field to create detailed images of organs, soft tissues, bones, and virtually all other structures inside the body.

5.1 WHAT IS THE DIFFERENCE BETWEEN A CT SCAN AND AN MRI?

Powerful magnets and radio waves are used to create images of the body. The main **difference** between CT and **MRI** is that the latter does not use X-rays. Other **differences** are that CT is faster to perform but has lower resolution.

5.1.1 What harm does an MRI do?

Magnetic **resonance imaging**, or MRI, is a method of producing detailed images of organs and tissues throughout the body without the need to use X-rays or "ionizing" radiation. The MRI test is painless, and the electromagnetic fields do not cause any known **tissue damage**.

Preparation by nurses

1. Emotional preparation by explaining what your exam consists of
2. Informing the doctor whether or not he or she can eat or drink anything between 4 and 6 hours before performing the procedure, according to the medical indication.
3. Tell him not to keep metal in his body.
4. Inform the technician of any pre-existing conditions
5. Guiding relaxation techniques
6. Offer a blanket for warmth
7. Offer comfortable robe
8. Instruct you to keep your eyes closed
9. Establish communication with professionals3. You can then resume your daily activities and a normal diet immediately AFTER the test.

6 POSITRON EMISSION TOMOGRAPHY (PET) SCAN

PET (positron emission tomography), what it is - Medical Tests. Positron emission tomography (**PET**) allows imaging of the inside of the body and **detects** the metabolic activity of cells. It is mainly used for the diagnosis and monitoring of cancer.

PET (Positron Emission Tomography) is a non-invasive diagnostic imaging and in vivo research examination that **is capable** of measuring the metabolic activity of the human body and **is** performed in a **Nucleous Medicine** service

This is a type of imaging test . A radioactive substance called a tracer is used to look for a pathology in the body. A **positron emission tomography** (PET) scan shows **how** organs and tissues are working. This is different from magnetic resonance imaging (MRI) and **computed tomography (CT**) scans

PET stands for Positron Emission Tomography and is a nuclear medicine technique in which radiopharmaceuticals labeled with positron emitters are used **to**

They allow biochemical-metabolic images of the human body to be obtained. In this paper we want to show **what** PET/CT **is** and its usefulness in **Oncology**.

The nursing staff is primarily responsible for ensuring that the acts of relationship are efficient and respond to the need to provide comprehensive care to the individual. The staff who are present at the time of notifying the patient of the performance of the test will be in charge of clarifying everything related to its preparation:

1. Fasting for 4-6 hours prior to administration of the radiopharmaceutical.
2. It is advisable to drink 0.5-1 liter of water the previous 2 hours. This facilitates a correct elimination of the tracer through the urine and reduces its retention in the ureters and excretory system of both kidneys.
3. There is no need to discontinue any medication.
4. The main stumbling block in nursing work is the diabetic patient, as they will need special care whose ultimate goal is to achieve a blood glucose level below 140 mg/dl before the administration of the tracer radium.
5. Removal of any metal objects.

6.1 ON THE DAY OF THE TEST, THE NURSING STAFF WILL WELCOME THE PATIENT AND START THE TEST:

1. Measure weight and height for dosing.
2. Obtaining a peripheral venous line and administering the radiopharmaceutical.
3. Advise the patient not to talk so as not to activate the muscles that act in the phonation process to maintain low glucose consumption.

4. The patient should empty the bladder prior to imaging for better visualization.
5. Comfort the patient and comment that the study can last between 20 and 45 minutes.

6.2 TELL HIM THAT AFTER THE TEST:

1. You can eat and drink right away.
2. It is advised to drink 2-3 liters of water that same day as the radiotracer is progressively eliminated in the urine.
3. Pregnancy will be avoided until the next menstruation.
4. No precautions will be necessary in terms of relationships with family and so on.
5. You will take extreme hygiene measures after going to the toilet, wash your hands, and make sure to flush the toilet.

6.3 EVOKED POTENTIALS.

A diagnostic study that provides information on the response of the brain stem and cortex to sensory stimuli caused by electrical impulses. They are classified into three types: Visual Evoked Potentials, Auditory Brainstem Evoked Potentials, and Somatosensory Evoked Potentials. They are indicated when lesions of the cerebral cortex, ascending pathways of the spinal cord, brain stem and thalamus are suspected. Its use is also of great help during the induction of barbiturate coma as brain protection and as a diagnostic test for brain death.

No prior preparation is necessary to perform this test. The patient has electrodes placed (glued with conductive paste and collodion) on the scalp and pinnae and/or on the shoulder, neck, spine.

Subsequently, it receives the different stimuli to obtain the corresponding evoked response. Thus, for the visual evoked potential, the patient receives a visual stimulus; For auditory evoked potential, auditory stimulus consists of hearing tones through an earpiece; and somatosensory evoked potentials are produced by electrical stimuli in feet and hands.

If the visual or auditory stimulus or the electrical sensation does not produce the expected wave at the right time and place, it means that there is some interruption of that nerve pathway and, therefore, this data will suggest a specific type of disease.

7 NURSING CARE FOR PATIENTS UNDERGOING ANGIOGRAPHIC PROCEDURES.

Contraceptive arteriography is the standard test in vascular diagnostic radiology. It is the most invasive test used to evaluate peripheral vascular disease and is useful in the diagnosis of arterial thrombi or emboli, arterial trauma, aneurysms and atherosclerotic occlusive vasculopathy, among other pathologies. It is a technique that carries a significant degree of risk and discomfort for the patient and its safe and effective performance requires considerable experience and technical skill. The following

document aims to provide clear and concise information that allows nurses to care for a patient during an angiographic procedure.

7.1 DIAGNOSTIC ANGIOGRAPHY. PRELIMINARY CONSIDERATIONS.

Angiography should be performed in a room equipped with radiological scopy, an image acquisition and storage system, monitor for ECG, BP and oxemia, vacuum socket, oxygen socket and CPR means. It is generally performed in the Vascular and Interventional Radiology room, located in the Radiodiagnosis service and can also be performed in a properly equipped operating room as far as radiological equipment is concerned. The structure and organization of the staff in a vascular and interventional radiology room is similar to that found in the surgical area. Despite the fact that the risk of sepsis or local infection is extremely low (0.003%), strict sterilization measures must be observed, and this means that the equipment that carries out the angiographic procedure is distributed as follows:

- 1/2 Radiologists
- 2 nurses (one circulating and one instrumentalist)
- 1 TER
- 1 AE

From the point of view of Nursing. What is the main problem we have to face?

- The patient's anxiety.
- Misinformation. Patients have a "puzzle" idea of the procedure provided by sources of information outside the healthcare staff (roommates, friends, relatives, etc.).
- Proper preparation of the patient.
- Infertility in the room during the procedure.
- The safe and effective performance of the prescribed technique.
- Hemostatic compression after catheterization.
- Recommendations to the patient for the next 24 hours.

7.2 BASIC ANGIOGRAPHY TECHNIQUE.

1. Preparation in the RXVI room.
2. Checking the nurse in the RXVI room means that the patient has signed the consent document and that he or she expresses knowledge about the technique that is going to be performed.
3. The patient's cooperation is essential both during the examination and in the following 24 hours.
4. Creating a climate of trust from the first moments is essential.

5. The patient must know that the nurse is there to TAKE CARE of him and that for this it is essential that he **communicates** any sensation that may help the nurse to identify possible causes of discomfort.
6. The nurse will inform the patient about the sensations they may notice during the procedure so that they do not perceive them as threatening and thus reduce their stress level.
7. He will also rehearse the apnea maneuvers that will be necessary throughout the procedure so that the patient knows what is expected of him.
8. Checking pulses distal to the puncture site is essential at this time for subsequent comparison in case of complications.
9. Before the procedure begins, the patient should be placed with an intravenous line for continuous administration of fluids and, if necessary, rapid administration of medications.
10. Check and assess blood pressure.
11. ECG monitoring and pulse oximetry.
12. The preparation of the instruments should always be carried out before the patient is in the RXVI room.
13. The instrument table will be prepared following strict asepsis measures and will be covered so that the patient does not see it.

Once the puncture site has been chosen, determined by the type of study to be performed and the physical examination of the pulses, the skin must be asepticized and the patient covered in a sterile manner to prevent contamination of the equipment used.

7.3 WHAT IS EXPECTED OF THE FUTURE?

NINDS-funded scientists seek to develop improved methods of additional screening to quickly and more accurately confirm a specific diagnosis and to allow them to investigate other factors that may contribute to the disease. Technological advances in imaging will allow researchers to see better inside the body, with less risk to the patient. These diagnoses and procedures will continue to be important clinical research tools to confirm a neurological disorder, track the progression of a disease, and monitor the therapeutic effect.

8 CONCLUSION

Teaching is the fundamental weapon in the training of the new generations, therefore, it is important to provide them with topics that help them to obtain information that is more up-to-date and timed every day, that is why, once the material was applied, satisfactory results could be obtained, verified in the students, so that it is decided to publish it in the various events that take place in the specialty. As well as, in high-impact journals.

REFERENCES

El cerebro y el sistema nervioso. [Internet] Consultado: 12/01/2024. Disponible en https://kidshealth.org

Enfermedades que afectan el sistema nervioso. (Neurociencias: MedlinePlus) [Internet] Consultado: 13/01/2024.Disponible en: https://medlineplus.gob

Aspectos a tener en cuenta para afrontar la resonancia magnética. [Internet] Consultado: 13/01/2024.Disponible en: https://www.fem.es

Soledad Fátima Vega Pozuelo[1,] Inmaculada Herrera Torres[2,] Eva Carreras Salcedo[3] cuidados de Enfermería, lumbar, Protocolo, punción. Revista Médica Electrónica Portales Medicos. 8 abril, 2018 [Internet] Consultado: 12/01/2024. Disponible en: https://www.revista-portalesmedicos.com:revista-medica

Arjona cosano, maría mercedes Procedimientos *enfermeros* en el servicio de *resonancia magnética*. Revista Científica del colegio 2017 págs. 67 -73 [Internet] Consultado: 12/01/2024. Disponible en: https://dialnet.unirioja.es

La enfermería como modelo de evaluación neurológica… 2023 [Internet] Consultado: 12/01/2024. Disponible en: https://revmedicaelectronicaa.sld,cu

Mark Freedman, MD. Diagnóstico de las Enfermedades Cerebrales, Medulares y nerviosas. Manual MSD. Temas medicos.2023 [Internet] Consultado: 12/01/2024. Disponible en: https://www.msdmanuals.com.oh

Tasinchana Bastida. Dladys Yuvani. Cuidados de enfermería en niños con problemas neurológicos. Vol.8, num.3 julio – septiembre 2022 [Internet] Consultado: 12/01/2024. Disponible en: https://dx.doi.org/10.23857/dc.v813

García-Lezama, Melissa; Carrillo Ruíz, José Damián; Moreno Jiménez, Sergio; Roldán Veladez, Ernesto. WHO CNSS 2021 incluye mutaciones específicas en gliomas que pueden ser identificadas con biomarcadores cuantitativos de resonancia magnética. Gac. Med. Méx. [Revista Interne t]2023 abril Consultado: 12/01/2024. Disponible en: https://doi.org/10-24875/gmm.22000313