

Tests and Technology

THIS FACT SHEET covers the various tests that are used in diagnosing and assessing patients who have acquired brain injury or a neurological condition.

Angiography

Angiography describes different ways of looking at the blood vessels of the brain. In catheter angiography, the radiologist (an X-ray specialist) inserts a catheter (a long, thin, flexible tube) into an artery in the groin. The radiologist moves the catheter through the arteries to the carotid artery in the neck, guiding the progress on X-ray. The catheter then releases a special dye and X-rays are taken as the dye flows through the blood vessels of the brain. This gives a very good picture of the blood vessels.

This is usually done as a day procedure in hospital. It takes about half an hour but you need to rest at hospital for a few hours afterwards because sedation or anaesthetic is required for the procedure. People occasionally stay overnight.

Catheter angiography is uncomfortable and there is a slight risk that it may cause a stroke or other less serious side effects. A less invasive procedure is Magnetic Resonance Angiography (MRA), which uses Magnetic Resonance Imaging technology (see MRI). MRA has no side effects but the picture it provides is not as good as the one produced by catheter angiography.

CT Scan

A CT scan (a Computerised Tomography scan, sometimes called a CAT scan) uses a scanner that encircles the person's head or body without touching it (it looks a bit like a very large doughnut). It takes X-ray pictures from many angles. A computer then uses these images to build cross-sectional pictures of the brain or another part

of the body. To make the detail clearer, a dye may be injected into a vein (usually in the arm), which may make the person feel briefly hot all over.

The test takes up to half an hour to complete and is painless. Most people can go home straight afterwards.

Spiral CT: Spiral CT is a new technique still being developed. The process for the patient is the same as the CT scan but the computer creates a three-dimensional, rather than two-dimensional, image on the screen that can be viewed from various angles.

EEG

An EEG (electroencephalogram) is a test to detect abnormalities in the electrical activity of the brain. Brain cells communicate by producing tiny electrical impulses. In an EEG, electrodes (flat metal discs) are placed on the scalp over different areas of the brain to detect and record patterns of electrical activity.

EEG is used to help diagnose the presence of several types of seizure disorder, such as epilepsy, and to look for causes behind unclear or confused thinking. It is used to evaluate head injuries, tumours, infections, degenerative diseases and metabolic disturbances that affect the brain.

The test is performed by an EEG technician in a specially designed room that may be in your health care provider's office or at a hospital. You will be asked to lie on your back on a table or in a reclining chair.

The technician will apply between 16 and 25 electrodes at different positions on your scalp.

The discs are held in place with a sticky paste and are connected by wires to an amplifier and a recording machine. The recording machine converts the electrical signals into a series of wavy lines that are drawn onto a moving piece of graph paper.

You need to lie still with your eyes closed, as any movement can alter the results. You may be asked to do certain things during the recording, such as to breathe deeply and rapidly for several minutes or to look at a bright, flickering light. This test causes no discomfort.

EMG

An EMG (Electromyography) measures electrical activity in muscle and can look in detail at small areas of muscle. It involves putting an electrode (in the shape of a fine needle) into the muscle at different points. It can be slightly uncomfortable but it has no after-effects. Sometimes a flat electrode is used on the person's skin.

Lumbar Puncture

In this procedure, a needle is inserted between vertebrae in the lower back to draw off some of the cerebrospinal fluid – the special fluid that bathes and cushions the central nervous system (the brain and spinal cord). A local anaesthetic may be given and some discomfort may be felt as the needle is inserted. This test can be used in conjunction with other tests to confirm a diagnosis of multiple sclerosis.

MRI

MRI (Magnetic Resonance Imaging) is similar to a CT scan but uses magnetism instead of X-rays to build cross-sectional pictures of part of the body. The magnetism comes from a large metal cylinder, which is open at both ends. The person lies on a couch inside this cylinder. Safe, low-energy radio waves are then passed into your body and absorbed by some of the tissues, which reflect back the radio waves. The magnet is turned on and off and reads these radio waves while the computer records this information and generates a two- or three-dimensional picture. Diseased tissue gives

off a different signal to healthy tissue, which the machine detects.

The test may take up to an hour to complete. MRI is painless and the magnetism is harmless but the cylinder makes some people feel claustrophobic. MRI cannot be used on anyone who is pregnant or who has a pacemaker.

Muscle Biopsy

This involves removing a small piece of muscle under a general or local anaesthetic, which is then sent to a laboratory for examination. It is used to confirm a diagnosis of muscular dystrophy.

Nerve Conduction Studies

Nerve Conduction Studies (NCS) look at how nerves are functioning. Electrodes (small flat discs) are placed over a nerve or muscle that is then stimulated using a small hand-held stimulator. The person will feel a mild prickling sensation. The electrodes pick up the resulting muscle activity. The test is quick, simple to do and is pain free.

PET Scan

A PET (Positron Emission Tomography) scan is another technique used to build cross-sectional pictures of the body. The person is injected with a glucose solution containing a very small amount of radioactive material. The scanner can "see" the radioactive substance and this shows the areas where cells are using the glucose. Healthy cells in the body pick up and use the glucose but damaged cells show up as areas where the glucose is ignored. Other than a minor injection, the scan is painless. The radioactivity fades quickly and has no known after-effects.

SPECT

SPECT (Single Positron Emission Computed Tomography) is similar to a PET scan but uses two cameras to build a three-dimensional image that can be studied from different angles on a screen.

Ultrasound

Ultrasound involves the use of very high frequency sound waves, higher than the human ear can hear. It is often used to investigate the arteries in the neck (carotid arteries) in relation to stroke. The person doing the test (an ultrasonographer) moves a small probe over the part of the body being investigated. When ultrasound is directed at the body part, the soundwaves “echo back” at different rates according to the different types of tissue detected. The computer measures these differences in tissue to build a picture that is displayed on a TV monitor.

The process takes about 15 or 20 minutes, is painless and has no after-effects. Ultrasound can also be used to generate heat in body tissues to relieve muscle tension or strain.

Videofluoroscopy

This is an X-ray of someone swallowing. The person is X-rayed with a video X-ray camera while swallowing spoonfuls of food or drink that contain a special substance that shows up on X-rays. The moving image is recorded on videotape. It shows clearly how the swallowing muscles are working and if any food or liquid is escaping into the lungs. The procedure takes 10 to 20 minutes.

Visual Evoked Response

The Visual Evoked Response (VER) test assesses brain function - particularly those parts involved in vision - by measuring electrical activity in the brain. A number of electrodes (small flat discs) are placed on the person's scalp using a clear jelly (the hair may need a wash afterwards) and are held there by something that looks like a rubber hair net. The electrodes pick up and record brain activity while the person watches a flashing light or a changing pattern of lights. VER is painless and has no side-effects.