The latest on strokes

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SCOR Global Life

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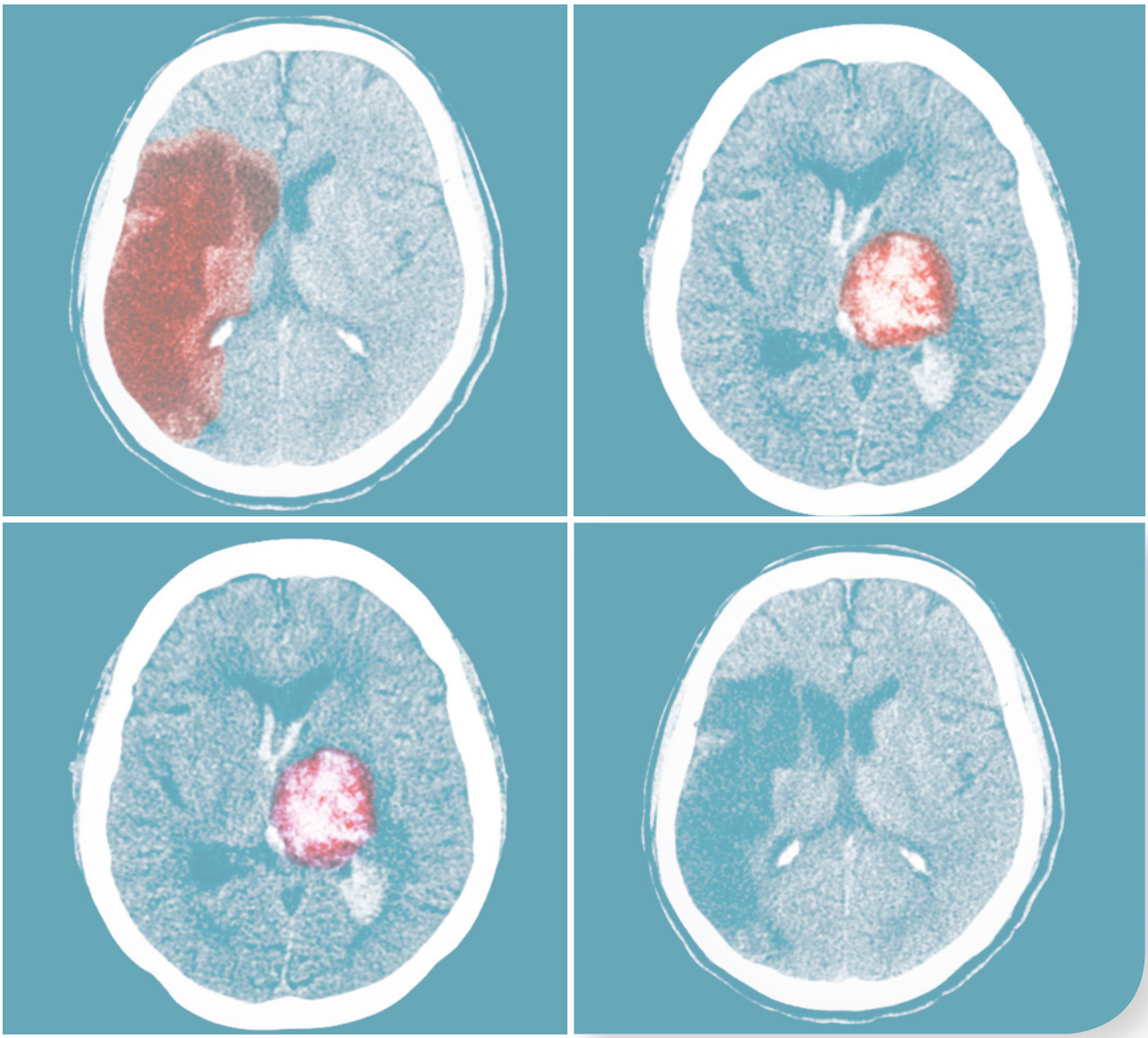
Introduction

Figures on cerebrovascular accidents (also known as CVAs*, generally strokes) speak for themselves, showing their high incidence: worldwide, 15 million strokes occur every year. As the cause of 10% of deaths, a quarter of them during the first year, stroke is the third leading cause of mortality in France and the second in the world. It is an illness of the aged, occurring at an average age of 73 years; and yet 15% of strokes occur in individuals under age 50.

In the United States, stroke was the fourth leading cause of death in 2013 and about 800,000 people are affected each year. In 2010, deaths due to ischemic strokes which can be attributed to high tobacco consumption accounted for more cases in Russia, China and India than in the rest of the world (Source: World Heart Federation).

Stroke is the most common cause of acquired physical disability and the second biggest cause of dementia in France. It is responsible for some 60,000 deaths with 130,000 to 150,000 new cases a year, or one stroke every four minutes. Although 70%-80% of people return home after a cerebrovascular accident, half of them will be left with a disability. The increase in incidence with age explains why stroke is becoming a leading cause of mortality in women, having reached the same level as myocardial infarction.

Each word marked with an asterisk is listed in the glossary at the end of the document.



In Europe, stroke ranks third in the list of causes of mortality. In men, it is responsible for 10% of deaths, after ischemic heart disease and cardiovascular diseases (32%), and then cancer (21%). In women, the rate is higher. Stroke is actually responsible for 15% of deaths, again behind ischemic heart disease and cardiovascular diseases (37%) and cancer (18%).

As for any condition leading to disabilities, the costs of strokes to society are considerable. As well as the cost of hospitalization, there are various other costs, as the victim is often supported by several different healthcare professionals (physiotherapist, speech therapist…) for several years. There can also be serious repercussions on the working life of the spouse, as his/her presence at home will be required more often.

Although the care of patients has changed much over the last few years, many improvements are still necessary. This is why, in France, the Ministry of Health has mobilized to implement the ongoing National Stroke Plan for 2010-2014.

Causes, types and mechanisms of the stroke

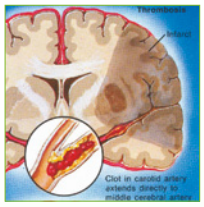
Different types of stroke

The great majority of strokes are ischemic: they represent 80% of cases. An ischemic stroke* (or cerebral infarction) is caused by the interruption of the blood flow to the brain, most often due to a clot blocking an artery. This deprives the brain of oxygen, leading to the destruction of a region of the brain. But ischemic strokes of hemodynamic origin can occur with a fall in blood pressure (such as from a heart attack) which deprives the brain of oxygen.

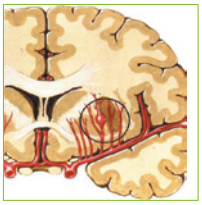
The remaining 20% of strokes are haemorrhagic strokes*, due to a ruptured artery. Bleeding occurs inside the brain, flooding the tissue and interrupting the blood supply. In 75% of haemorrhagic strokes (or 15% of all strokes) this is an intra-cerebral haemorrhage, and 25% of cases (5% of the total) a ruptured aneurysm*.

The latter usually affects younger subjects, under the age of 40. Meningeal haemorrhage requires neurosurgery, while other types of stroke are usually treated medically.

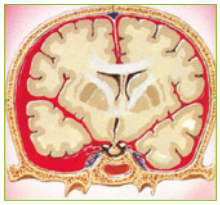
Main mechanisms of stroke



Blocked artery (80%):
cerebral infarction; transient ischemic attack (TIA)



Ruptured artery (15%):
intracerebral haemorrhage



Ruptured aneurysm (5%):
causing meningeal bleeding*

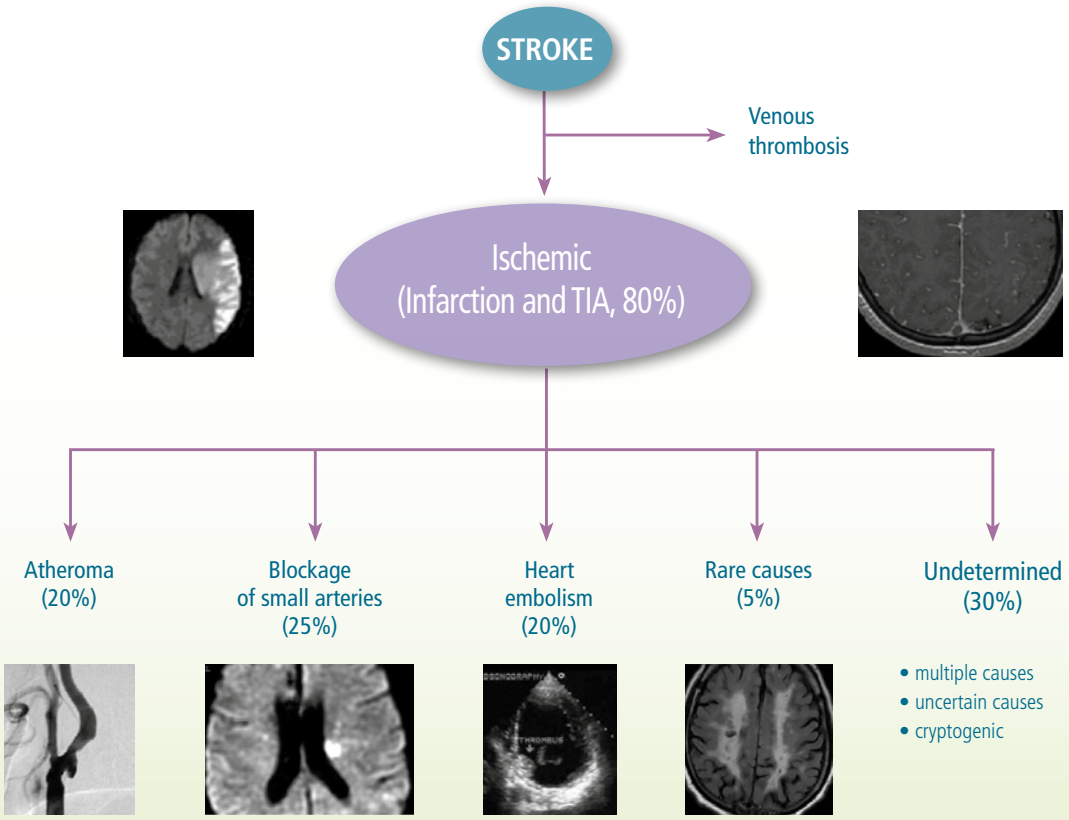
Source: Groupe Hospitalier Paris Saint Joseph

Multiple causes

The 3 main causes of ischemic stroke are:

- **Atherosclerosis,** causes ~ 20% of cases. This is characterised by a build-up of plaques of atheroma* on the artery walls. Eventually, these plaques can obstruct the blood vessel, either by a lesion on the artery wall (sclerosis), or by plaque rupture leading to thrombosis*.
- **Lacunar infarction*** or a blockage of the small arteries in the brain, represents about 25% of strokes. Certain risk factors cause a thickening of the artery walls which eventually blocks the blood vessels (this is known as local thrombosis).
- **Embolism*** of cardiac origin represents about 20% of cases.

Cerebral infarctions / TIAs: a constellation of causes



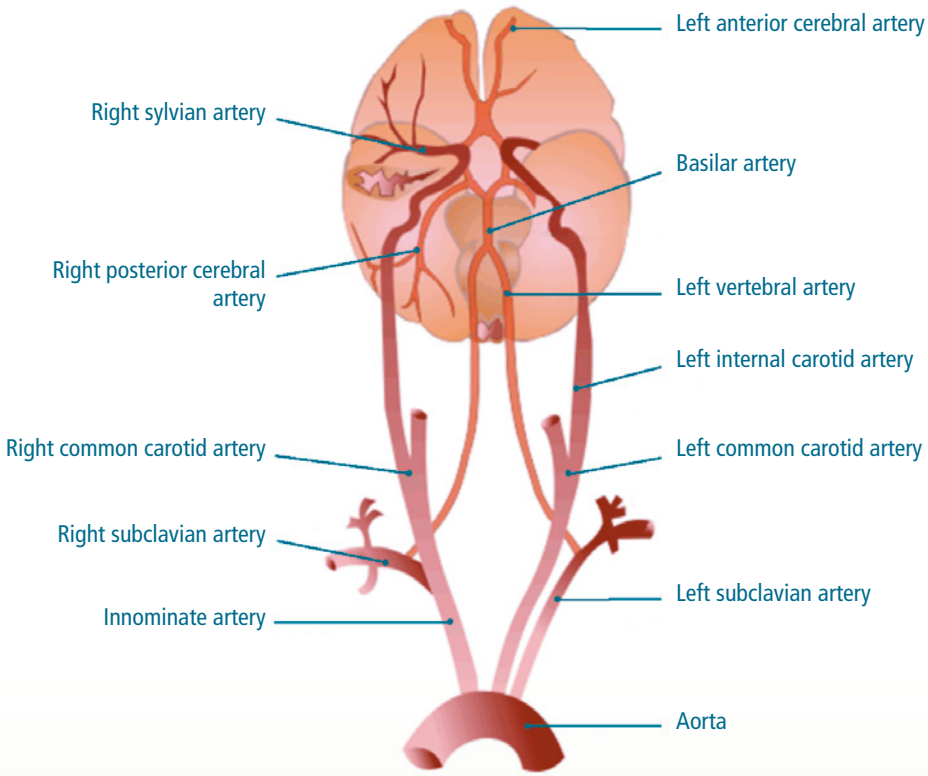
Source: Groupe Hospitalier Paris Saint Joseph

- In addition to these main causes, there is also artery dissection, and a number of **rare causes** (5%) - for example: blood diseases, antiphospholipid syndrome (APS), metabolic diseases, Fabry's disease, hemoglobinopathy, various forms of cerebral arteritis - and **undetermined causes** (30%).

These figures may vary from one cause of death register to another depending on how vigorously the attempts were to identify and define the different causes, including the rarer ones. The rare causes are more frequent in younger subjects, in particular carotid artery dissection (see page 9).

The causes of stroke vary according to age. Thus, some cardioembolic causes, such as atrial fibrillation, become more common with age, increasing from 20% in the under-40s to 30% in the over-70s. On the other hand, the undetermined causes decline with advancing age.

Causes of cerebral infarctions/TIAs



Source: http://www.cardiodiac.net/SystemeCardiovasculaire.htm

The transient ischemic attack* - TIA

TIA has recently been redefined by the French Health Authority. It is a brief episode of neurological dysfunction due to focal ischemia, in the brain or retina whose clinical symptoms typically last less than one hour, with no evidence of acute infarction on brain imaging.

A TIA is difficult to diagnose as there are many possible aetiologies for symptoms: symptoms could just as easily have been caused by a simple vasovagal episode, hypoglycemia, confusion, peripheral vertigo or migraine…

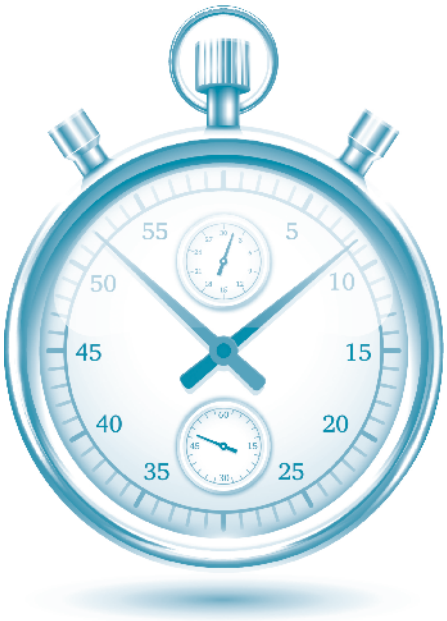
TIAs are a serious warning sign of impending stroke. In 20%-25% of stroke cases, patients report after the event, that symptoms had occurred in the previous two or three days; hence the need for rapid intervention as a cerebrovascular accident causing permanent sequelae can occur in the hours following TIA symtpoms. The rule therefore is that a TIA in the the last four days requires urgent hospitalization, if possible in a neurovascular unit.

Arterial dissection

Arterial dissection is the most common cause of stroke under age 50: it represents 30% of cerebral infarctions in young subjects. It results from rupture of the endothelium, the innermost layer of the artery, allowing a collection of blood (hematoma) to form in the arterial wall. A blood clot often forms, which can then migrate and cause a stroke. In half of cases, the hematoma occurs as a result of trauma; in the other half, it occurs spontaneously, with no identified cause. Arterial dissection is characterised by local symptoms (headaches, neck pains…) and ischemic symptoms if the dissection causes a stroke. Such a one-off episode can sometimes cause serious sequelae.

To measure the risk of stroke after a TIA, a risk assessment tool called the **ABCD2 score** is used:

- **A** for "age": if the patient is over 60, this counts 1 point;
- **B** for "blood pressure": if the patient has over 140/90 mm Hg: 1 point;
- **C** for "clinical features": 2 points for unilateral weakness, 1 point for speech disturbance without weakness;



- **D** for "duration of symptoms": 2 points if the symptoms last more than one hour; 1 point for between 10 minutes and one hour, 0 points for less than 10 minutes;
- **D** for "diabetes": an extra point is added for a patient with a history of diabetes.

The ABCD2 score identifies the patient at greatest risk: with a score of 6-7, the risk of having a stroke is at its maximum within 48 hours (8%-10% risk).

A score below 4 indicates low risk. Insofar there is still a risk, intermediate or high scores nevertheless justify hospital care to avoid a stroke.

Treatment of stroke

A stroke is an emergency

Stroke treatment is a complex area, that can be separated into acute treatment and chronic treatment of the causes and subsequent neurologic deficits. Treatment takes place in the hospital and in the community, with the NVU* (neurovascular unit) as the cornerstone of the system.

Stroke: varied signs

Disorders affecting one side of the body
• Weakness on one side: arm, leg, face or whole of one side ⊕ hemiplegia
• Numbness (tingling) on one side ⊕ paresthesia
Visual problems
• Sudden blindness in one eye ⊕ monocular blindness
• Half of visual field missing ⊕ homonymous hemianopsia
Language disorders
• Difficulty articulating ⊕ dysarthria
• Difficulty in finding one's words, syllable inversion, comprehension deficit ⊕ aphasia*

Source: Groupe Hospitalier Paris Saint Joseph

Acutely, stroke is an emergency because it is a dynamic phenomenon: the first symptoms appear and the damage begins to spread. In the beginning, the drop in the blood flow leads to dysfunction in the nerve cells; but the nerve cells are not yet dead and could therefore recover.

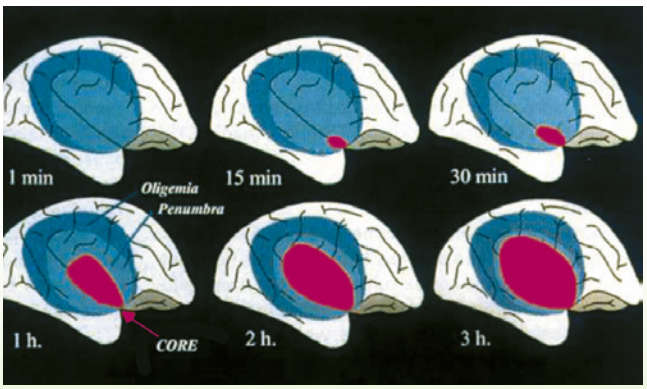
The faster the intervention, the greater the chances of recovering the area known as the "penumbra", the ischemic part of the brain that can be saved.

The neurovascular unit (NVU)

In the event of signs of a stroke (see VITE diagram), call for emergency assistance and note exactly what time the first symptoms began and what sort of symptoms they were, because this is the starting point for an important countdown. The patient should remain lying down; the elevated blood pressure must be taken into account and it is important not to give the patient anything to eat or drink, in order to avoid any risk of aspiration pneumonia.

Stroke = Emergency

Penumbra (in blue)
= area of the brain to saved
= target of the treatments



Source: Groupe Hospitalier Paris Saint Joseph

There are awareness-raising campaigns, such as VITE in France or FAST in English-speaking countries, which are intended to educate the general population so that they know what to do in the event of a suspected stroke.

Face drooping **Arm weakness** **Speech difficulty** **Time to call emergency**

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The patient will be treated as an emergency case and taken to the neurovascular or critical care unit. The NVU is a department where a team of healthcare professionals specially trained in stroke medicine work together: neurologists with strong links to cardiology, radiology with a neurological bias, nursing staff, are all well aware of the possible complications of strokes.

Most of the rehabilitation services are also represented: speech therapists, occupational therapists, physiotherapists, psychologists, neuropsychologists, social workers…

Treatment

The first action will be imaging of the **brain**. Before neuro-vascular treatment can begin, it is necessary to know whether it is an ischemic or a haemorrhagic stroke. This requires rapid hospitalization, by ambulance, so that brain scans can be done. After stabilization of vital signs, brain imaging will occur soon after the person arrives at the hospital. The recommendations in Europe emphasise that MRI scanning is preferable to a CT scan, as it provides more precise images of the damage to the parenchyma and the arteries. Emergent scanning is performed to rule out haemorrhagic stroke, as treatment with thrombolytic drugs could worsen that condition.

Thrombolysis with r-tPA* is the main emergency treatment with the aim of clearing the blocked blood vessel. It is used for ischemic strokes and has proved its effectiveness since the mid-90s. The time limit above which thrombolysis is too risky is now known: the benefits fall off over time until a point is reached where the treatment becomes neutral, and even harmful more than 4.5 hours after the beginning of the first symptoms. Ischemic brain tissue will eventually be prone to bleeding, resulting in small haemorrhagic transformations which increase in the hours after stroke onset, ultimately risking more bleeding with thrombolytics. The risk of thrombolysis is therefore bleeding, and this risk is considered too high 4.5 hours after the onset of symptoms: the treatment is therefore no longer given after that. On the other hand, the sooner treatment with thrombolytics begins, the greater the benefits for the patient.

Other emergency treatments are recommended for strokes, in particular blood thinners (aspirin, anticoagulants) in the case of an ischemic stroke, or for a brain haemorrhage treatments to control arterial blood pressure (in particular reducing the blood pressure helps to reduce the size of the hematoma), combatting fever and hyperglycemia, preventing food entering the airway, bronchial congestion, bad position-ing, phlebitis in the lower limbs. Rehabilitation should begin in the acute phase (physiotherapy, speech therapy…).

It is essential that strokes be taken care of by an NVU if available, as this reduces the risk of subsequent dependency, more than any other treatment. This explains why one of the main priorities in the National Stroke Action Plan for 2010-2014 consisted of setting up approximately 140 NVUs in France, to cover the entire country: This number has now virtually been achieved. Fifteen years ago there were only 12 NVUs in the country…

For isolated areas, telemedicine systems are currently being rolled out, so that local emergency departments without neurological capabilities can be linked up with a reference NVU. Thrombolytics can be given outside an NVU, as long as it is after consultation of a neurovascular specialist. Currently in France, fewer than 10% of strokes receive thrombolysis. The aim is to increase this rate, which is 30% in Scandinavia.

Risk factors

The # 1 risk factor for stroke is age: the older we get, the higher the risk. Sex and genetic predisposition are other non-modifiable factors.

Beyond these non-modifiable elements, the risk factors for stroke are similar to those for cardiovascular diseases, but vary in their order of importance. For example, whereas cholesterol is the main risk factor for heart disease, it is a less important factor in stroke.

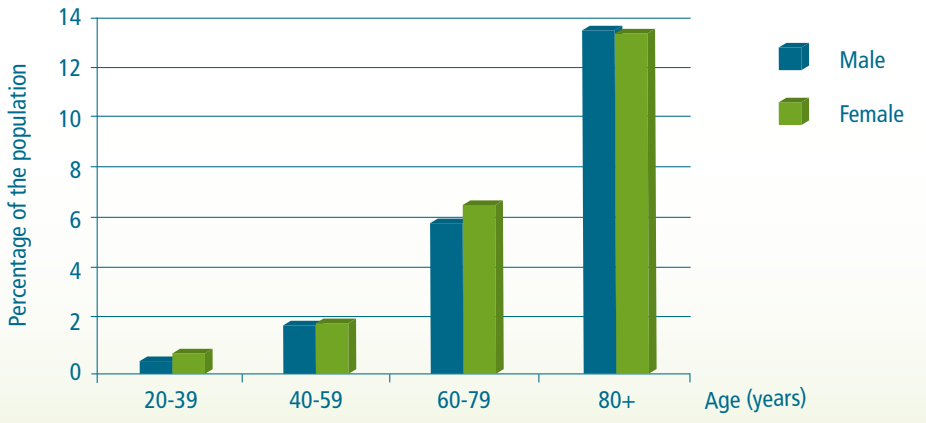
The main risk factors for stroke:

- Arterial hypertension (AHT);
- Tobacco;
- Hypercholesterolemia;
- Persistent atrial fibrillation;
- Diabetes;
- Alcohol;
- Obesity;
- Sleep apnea.

AHT is by far the biggest risk factor: when a stroke is suspected, stabilising the arterial blood pressure is essential, whatever the age of the patient. For example, in a hypertensive patient, a drop of 10 mm Hg in their systolic blood pressure or 5 mm Hg in their diastolic blood pressure can reduce the risk of stroke by about 35%.

The risk of a recurrent stroke is also directly linked to treatment of blood pressure. This is why a patient leaving a hospital after having a stroke, even if he/she did not suffer from AHT before, will often be given anti-hypertension treatment: this is the best way of preventing recurrence (primary prevention).

Prevalence of stroke by age and sex



Source: Go A et al. Circulation 2014;129:e28-e292

To sum up, a person suffering from high blood pressure, who smokes, has diabetes, a history of atrial fibrillation and cardio-vascular disease, has all the risk factors together: a woman aged over 55 will have a 27% risk of having a stroke within 10 years; for a man of the same age, the rate is 22%. The risk falls to less than 3% if none of these risk factors is present, hence the importance of tightly controlling them.

Criteria for severity, after-effects and prognosis

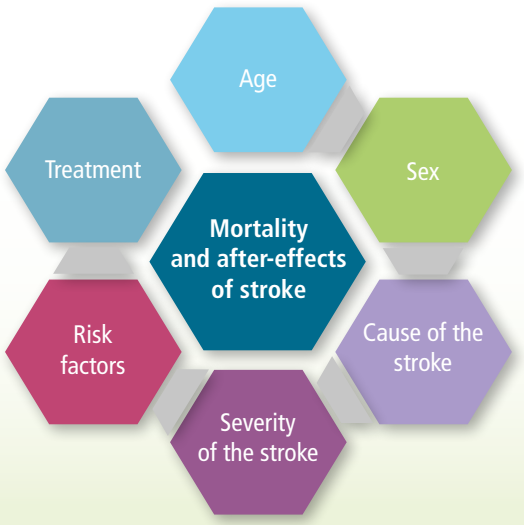
Criteria for severity and after-effects

Post-stroke recovery depends to a large extent on initial severity and promptness of treatment, and whether treatment is given under specialists in stroke, ideally in an NVU or Stroke unit.

Age is a decisive factor: mortality in the first year ranges from 15%-30% depending on age and sex; 28% of women over 65 die within the first year, compared to 18% between the ages of 45 and 64. In men, these rates are 25% and 14% respectively.

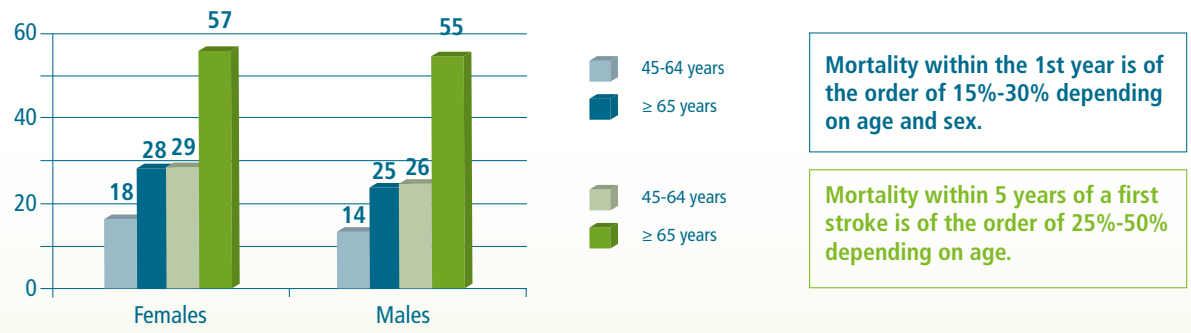
Four patients out of five return home after a stroke, which implies that adequate care must be in place (assisted care, living with someone, frequent social contacts) and the disability is mild to moderate. 20% return to work: this is only possible if the job is more a repetitive one than one that requires reflection and creativity. Returning to work most often requires that the patient not have any aphasia disorders, as a problem expressing oneself is is usually much more troublesome than a comprehension deficit in an employment setting.

Factors affecting mortality and the residual effects of stroke



Source: SCOR Global Life

Proportion of patients dying within 1 and 5 years of a stroke



Mortality within the 1st year is of the order of 15%-30% depending on age and sex.

Mortality within 5 years of a first stroke is of the order of 25%-50% depending on age.

Source: Go A et al. Circulation 2014;129:e28-e292

The after-effects of a stroke vary in degree

Main physical sequelae - visible

- Motor disorder/spasticity (stiffness), gait and balance problems;
- Coordination of gestures;
- Epilepsy caused by scar tissue;
- Sphincter dysfunction.

Less visible sequelae - behavioural disorder and personality change

- Fatigue: a person who recovered well from a stroke will still suffer from asthenia for several months;
- Anxiety / emotional problems / hyperemotivity;
- Depression: in certain cohorts, 5 years after a stroke, up to 50% of people are suffering or have suffered from depression;
- Pain (thalamic syndrome, complex regional pain syndrome...);
- Sexual dysfunction, diverse and multifactorial, in 30%-50% of people;
- Cognitive impairment (including dementia) in 30%-50% of people.

Cognitive impairment after a stroke is common in younger subjects. They may present dysfunctions that are only revealed in a work situation (for example preventing them from working on two screens at a time, due to complex visual difficulties), but do not interfere with their everyday lives.

Cases of dementia are also frequent. A study carried out on 169 patients aged over 40, followed up for three years, showed that more than a quarter of them were diagnosed with dementia within the 6 months following the stroke. A certain number of predictive factors were highlighted, including age, pre-existing cognitive decline, the severity of the deficit, the presence of diabetes or associated silent brain infarcts, visible on a scan (indicating that the stroke was not an isolated incident).

In a certain number of cases, a stroke triggers neurodegenerative diseases such as Alzheimer's.

Vascular dementia can be linked to multiple infarcts or subcortical ischemic vascular disease. It can also be secondary to a single infarct. As well as the scale of the stroke, there are also strategic locations where it can occur: a small stroke in a sensitive area can cause major cognitive impairment, bringing the patient within the criteria for dementia. For example, a stroke located in a region where there are important connections between the deep regions of the brain and the frontal cortex will block circuits that are essential to the intellectual functions.

Leukoaraiosis

Leukoaraiosis is the rarefaction of the cerebral white matter due to microvascular changes. Appearing with age, leukoaraiosis becomes a problem when it reaches an advanced stage. Under the influence of particular factors such as hypertension and diabetes, leukoaraiosis will then be a source of cognitive impairment, leading to balance and gait problems, as well as mood changes. It is not a stroke, but its origins are also vascular: it can cause profound changes in the brain and aggravate the consequences of a stroke. Depending on the extent and severity of the leukoaraiosis, the risk of dementia may increase.

Can stroke sequelae be predicted from the acute phase?

There are a number of different predictive factors for sequelae, such as:

- The initial NIHSS score (National Institute of Health Stroke Score): if this neurological impairment score, which is validated all over the world and in universal use, is higher than 20, it is a predictive factor for debilitating after-effects;
- Initial consciousness disorders;
- Age: an elderly person recovers less well;
- Type/location of the stroke: areas in the brain vary in strategic importance; the area destroyed can be identified on brain scans and this can help predict the scale of the sequelae;
- The stability of the neurological impairment during initial hospitalization: progress in the first few days, in particular the appearance of signs of recovery, is essential to outcome.

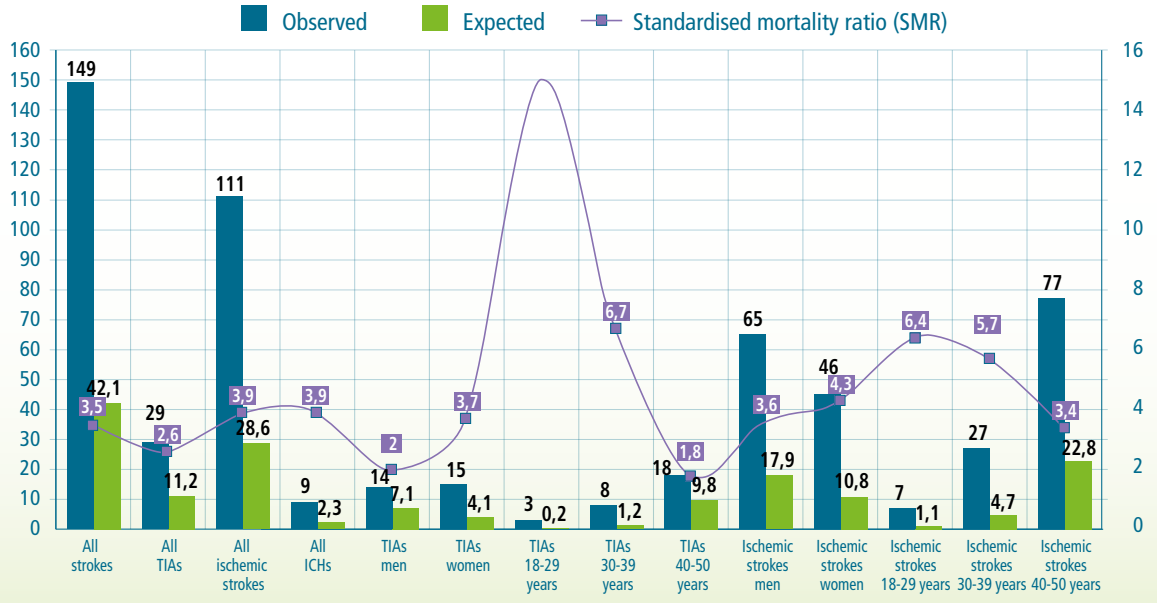
However, there are many counter-examples which lead us to qualify this initial prognosis. Patients whose clinical condition has not changed for 15 days sometimes still recover well afterwards.

Stroke prognosis

Stroke is the 2nd greatest cause of mortality in the world.

In addition, in terms of years lost to death or incapacity for work, no other neurological condition has such high years of productive life lost figures: stroke can and does affect people in the midst of their working life.

Cumulative death rate over 20 years depending on sex in adults aged 18-50 surviving 30 days after a stroke, compared to the general population



Source: JAMA, March 20, 2013—Vol 309, No. 11

Today, there are disparities around the world in terms of mortality. Generally, it is lowest in Europe, whilst it is increasing in Eastern countries and East Asia; however, this observation should be treated with caution, as in fact these countries are increasing their level of detection of strokes. The figures show that, globally, mortality has been falling progressively since the 1990s, in particular in industrialised countries.

The essential point that comes out of the different studies is the need to act on the main risk factors for stroke, especially arterial blood pressure. This is without doubt an essential factor in reducing deaths from stroke. Blood pressure treatment must also be accompanied by better control of the other risk factors (diabetes, hyperlipidemia, reducing tobacco consumption, healthier lifestyles…) and an improvement in healthcare systems (development of NVUs, increased use of thrombolysis).

In terms of excess mortality, a Dutch study published in 2013 shows that, after an ischemic stroke, the risk of death over time is multiplied by 3.6 for a man compared to the general population and by 4.3 for a woman.

After a TIA, the proportional death rate in women is approximately twice that in men, or a relative risk of 3.7 in women compared to 2 in men.

In young people, the stroke-related death rate in the first 5 years is low (about 5%); however, the relative risk compared to the general population of the same age, is high, as multiplied by 6.4.

The same study also looked at **excess mortality according to the cause of the stroke.** Based on Standardized Mortality Ratios (SMR), cardioembolic causes had the highest SMR (9.2), followed by co-existing causes (8.3) Likely athero-thrombosis* (4.3), lacunar strokes (4.1), and definite athero-thrombosis (3.2). Cryptogenic* causes, frequent in young victims, had an SMR of 2.2, while rare causes had an SMR of 3.4.

Different studies have identified **predictors of early death after a stroke,** some of which are specific to the person (age, sex), whilst others are specific to the symptoms of the stroke (vigilance impairment, motor deficiency, head and eye deviation, initial loss of consciousness…), to medical background (a history of stroke, being in an institution prior to onset…), or to the nature and scale of the stroke… One thing is certain, however: mortality is higher during the acute phase of stroke in the event of a brain haemorrhage compared to cerebral ischemia. Studies reveal that death in hospital linked to brain haemorrhage is much higher than for ischemic strokes in the first few weeks.

The death rate also varies according to the causes of cerebral infarction: lacunar infarction has the most favourable prognosis, infarction of cardioembolic origin the least favourable. Infarction due to atherosclerosis has an intermediate prognosis.

The scale of a stroke also constitutes a predictor of outcome: this is true for both brain ischemia and brain haemorrhage. Intraventricular haemorrhage is a negative factor as it causes neurovegetative disorders and an icreased risk of cardiac arrest. The location of the cerebral haemorrhage is an important factor; the closer the hematoma is to the axis of the brain, the greater the risk.

Having already had a stroke is a vascular risk factor, the risk being stroke recurrence or myocardial infarction. The frequency of stroke recurrence is of the order of 5%-15%. In a population of stroke victims, it is generally considered that over one year, about 1/5 of the strokes will be recurrences. Recurrent strokes have a death rate twice as high as first strokes, with death more often due to the stroke itself rather than to another vascular event. Several factors affect recurrence: age (as always), inadequate control of hypertension, poor compliance with medication (more than half of patients are failing to take their anti-coagulants correctly after a few months), monitoring of risk factors, and the aetiology of the strokes.

Brain imaging

Medical imaging is one of the fundamentals in diagnosing and treating stroke. There are two main types of imaging tools: the CT scanner and the MRI (magnetic resonance imaging) scanner. They work on very different principles.

CT scanner*

The CT scanner uses X-rays directed from multiple angles coupled with digital image processing. The beam of X-rays partially absorbed by the tissues is picked up and processed to produce images corresponding to successive slices (known as axial cross section images) of the body region examined. The differences in absorption by different tissues correspond to differences in density, represented by a grey scale ranging from white (bone) to black (air) and including multiple shades of grey (parenchyma, muscle, fat).

The computer processing of the image, by varying the contrast, enables constituent parts of an organ with different densities to be examined using the same cross section (e.g. dome of the skull and brain parenchyma). CT scanning is quick, easily accessible and without contraindications, but it allows only a limited approach to the constitution of the tissues. It also delivers a higher dose of radiation than a traditional X-Ray.

MRI*

MRI uses H+ protons*, which behave like small magnets. All the protons in the body are randomly oriented and spin in a disordered way. MRI scanning consists of placing the patient inside a powerful magnetic field so as to orient the H+ protons in the same direction, then applying a radiofrequency wave whose effect is to disturb the protons so that they fall out of alignment; when the magnetic pulse is stopped, the protons return to their initial state whilst echoing a signal that depends on the characteristics of the tissue they belong to.

The time needed for the signal to return to its state of balance varies according to the tissue. These properties are used to produce images. T1 sequences are short sequences: the CSF (cerebrospinal fluid) is black (long relaxation time) and fat is white (short relaxation time). T2 sequences are longer sequences that study signal abnormalities: CSF shows as a hypersignal (= white), grey matter, which contains more water, shows as a more marked hypersignal than white matter, which contains more fat.

As well as the basic sequences, many other sequences are used in MRI scanning:

- **FLAIR sequence** (Fluid Attenuated Invasion Recovery): T2 sequence in which the free water (and therefore the cerebrospinal fluid) signal has been removed. The grey matter/white matter contrast is the same as in a T2 sequence.

Eliminating a hematoma

CT scan: hyperdensity

MRI: T2*

Source: Dr S. Gerber, GHPSL

- **T2* sequence** (ferromagnetic artifacts sequence) uses the ferromagnetic properties of blood (hemoglobin contains an iron atom whose status changes according to the progressive organization of the hematoma) the presence of a blood clot will generate a ferromagnetic artifact which will present a clear hyposignal.

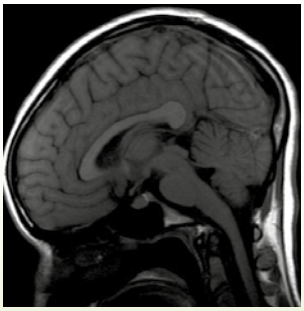
Diffusion MRI and MRI angiography

In investigating cerebrovascular accidents, two other MRI sequences are often used: diffusion MRI and MRI angiography.

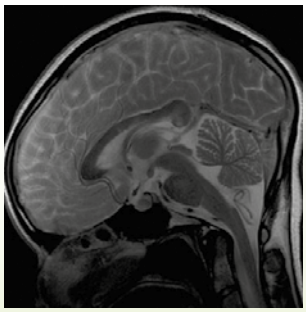
- **Diffusion MRI:** a functional imaging sequence that consists of studying the movements of the H+ proton and its distribution between intra and extracellular environments. Brain ischemia is accompanied by a halting of the diffusion on either side of the membrane. This restriction in diffusion is visible very early on after the onset of the clinical stroke signs. This diffusion sequence is therefore of considerable interest for the early diagnosis of strokes.
- **MRI angiography (MRA):** a sequence that only takes into account the signals from protons circulating at the speed of an artery or vein so as to obtain a representation of the blood vessels (pseudo-angiographic). In the evaluation of stroke, this is the sequence than can identify the location of a blockage or stenosis*.

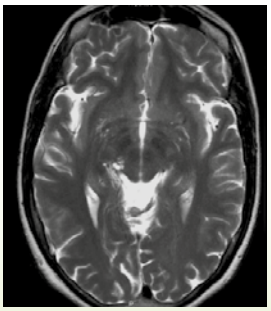
How to recognize T1, T2, FLAIR, T2*…?

T1

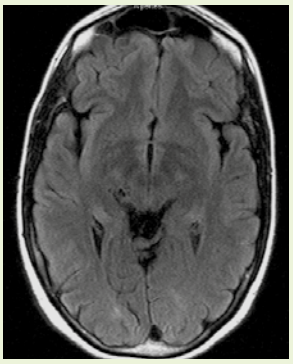


T2

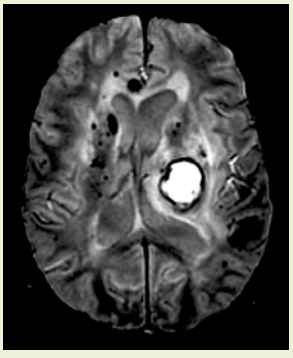




FLAIR: Fluid Low Attenuation Inversion Recovery



T2*



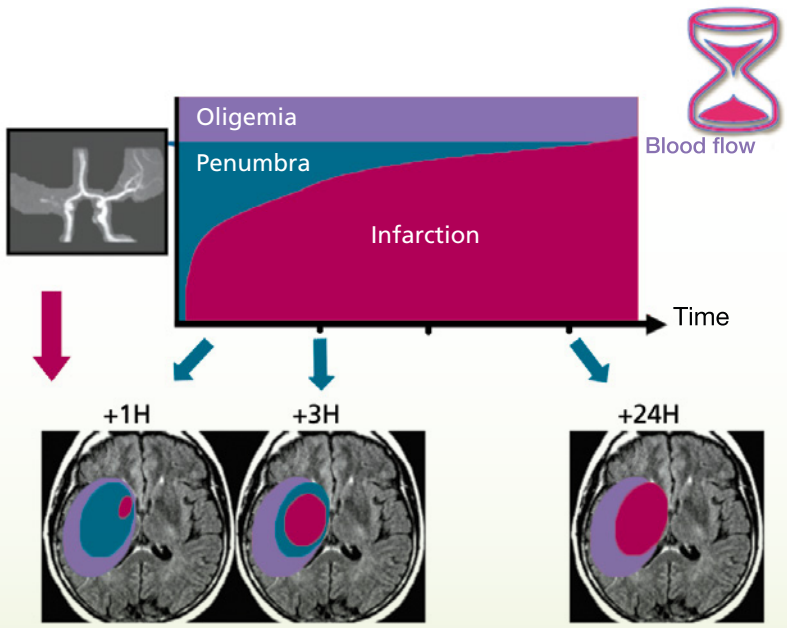
Source: Dr S. Gerber, GHPSL

These different tools enable MRI scanning to be used on an emergent basis to obtain a rapid diagnosis, to shorten the timeline, to assess the risk of complications, and to search for the cause of a stroke. The aim is to determine whether thrombolysis may be utilized. Fast action is needed to save brain cells: time is brain.

MRI scanning is less available than CT scanning and has some absolute contraindications: pacemaker, some intracranial aneurysm clips, intraocular metal foreign bodies… When this information is not known, the MRI may be cancelled. Agitation and claustrophobia can make it impossible to carry out the examination or obtain the results.

Nevertheless, MRI scanning remains more sensitive and more effective than CT scanning in detecting early ischemic stroke.

Stroke = Time is brain



Source: Remerciements Pr C. Oppenheim, CHSA

How to approach the risk

In risk selection

What can be said about stroke assessment in life and health insurance?

There are three stages in assessing the risk in an underwriting file: knowing what information is necessary and relevant to assess the risk; identifying the most complex cases; and determining the criteria (good or bad prognosis) which will be taken into account in the assessment.

Constitution of the underwriting file

Initial assessment and recent (specialised) neurovascular follow-up assessment. The initial specialised neurovascular assessment gives the diagnosis and the aetiology. Ideally it will be provided by an NVU, failing that the consulting neurologist if the applicant was not treated in an NVU. Later, a recent (less than 6 months old) specialised neurovascular assessment will also be necessary. In the case of a stroke that occurred several years ago, a one-year old assessment will be sufficient to know what happened, what the treatments were, how the patient progressed, what his/her condition is now, and if there are any after-effects.

Medical check-ups: assessment of other risk factors and vascular territories involved. The initial assessment and the neurovascular follow-up assessment must be completed by a recent medical assessment, dated in the last 6 months, in order to see if there is evidence of any aggravating risk factors. Medical imaging reports (MRI scans, CT scans, Doppler echocardiograms) will also provide information on the type of stroke. The scale of the stroke and the territory infarcted also provide useful information, particularly on the severity of the sequelae. They also determine whether other vascular territories are involved and if there is, for example, associated heart disease or other peripheral arterial disease, for example.

The hospital report must also be requested if it is not already in the file.

The highest risk cases

A guarded approach will be adopted in the 1st year, as well depending on the control of the risk factors and in the event that it is confirmed that other vascular territories are affected.

It is necessary to have a year's clinical observation after the episode, as in-hospital mortality is high, and also to allow time for the patient's condition to stabilize so that any sequelae can be assessed. Other information concerning the applicant is also important: is it his/her first stroke or a recurrence? It is also necessary to know what the neurological after-effects are: depending on the location of the stroke, the sequelae may be serious to varying degrees, or on the other hand, limited enough to allow an almost complete recovery.

Particular vigilance will be necessary if there are any uncontrolled risk factors: AHT, tobacco dependence, hyperlipidemia, diabetes... The same will apply if there is polyvascular disease, persistent atrial fibrillation, aneurysm or uncorrected vein malformation or any systemic disease.

Criteria for assessment

These will depend on the cover being taken out (death, total disability, temporary disability, long-term care, accident…), on the type of CVA (TIA, ischemic stroke, haemorrhagic stroke or lacunar stroke), on the applicant's age and the extent of the sequelae, which can lead to different excess mortality rates.

Claims

Principles

- There are two main types of stroke: ischemic and haemorrhagic;
- For disability, a 6-month assessment of cognitive function, motor function, sensitivity, functional disability is indispensable to the correct management and knowledge of the risk to be covered.

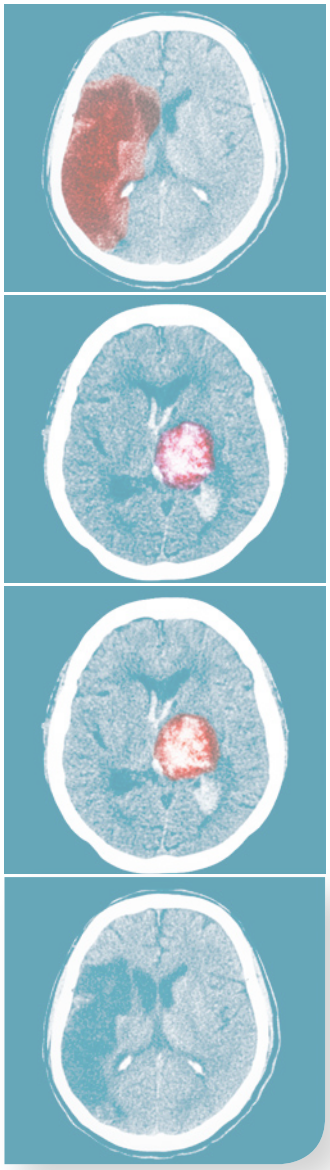
File

Initial and recent medical reports:

- Hospital report;
- Neurological/speech assessment 6 months after the stroke.

A nuanced approach to the claim depending on

- The benefit in question;
- The definitions in the contract;
- The type of stroke;
- The age of the insured;
- The associated risk factors and comorbidities.



Glossary

Aphasia: Disturbance or loss of the ability to communicate or understand acquired language, spoken or written, unconnected to dementia, sensory disorder or dysfunction of the pharyngeal-laryngeal muscles (dysphonia).

Atheroma: This is mainly fatty material that is deposited in "plaques" on the walls of the arteries.

Atherothrombosis: Combination of atheroma and thrombosis.

Cryptogenic: Synonym for idiopathic or unknown.

CT: Computer-assisted tomography. A medical imaging technique that uses X-rays combined with computer technology to produce cross-sectional images of the organs in the human body.

CT scanner (principle of the examination): The patient lies on a bed that slowly moves through a ring containing an X-tube and an array of detectors. The beam of X-rays passes through the patient's tissues; the detectors pick up the signal to produce cross-sectional images of the tissues according to their density.

CVA: Cerebrovascular accident (or stroke). Occurs in the event of damage and destruction of brain cells. May be caused by ischemia or a haemorrhage.

Downstream embolism: Embolism affecting a territory downstream of its starting point.

Embolism: Obstruction of a blood vessel by a foreign body, suddenly interrupting the circulation of a fluid in the body, blood or lymph.

Haemorrhagic stroke: Caused by bleeding either in the brain parenchyma (tissue) or in the cavum subarachnoidale (in the meninges). Hypertension predisposes to this type of ictus. Congenital malformations (cerebral aneurysm) can also be a cause of haemorrhagic stroke.

Infarcted: Refers to necrotic organic tissue.

Ischemic stroke (cerebral infarction): Can be either thrombotic or embolic.

Lacunar stroke (lacunar infarction): This occurs when small arteries in the brain are blocked. It is very often discovered by chance on MRI or CT scans; this type of infarction occurs in the deep white matter in the brain and seems to be associated with a more favourable prognosis.

Meninges: The three superposed membranes covering the brain and the spinal cord. (G. GÉRARD, Anat. hum., 1912, p. 46). From the outside in: the Dura mater (hard mother), (...) the soft meninges (...), consisting of a parietal layer, the arachnoid (...) and a visceral layer, the Pia mater, (...) between these two layers the cerebrospinal fluid circulates (Méd. Flamm.1975).

MRI: Magnetic resonance imaging. A medical imaging technique that picks up the signals emitted by the atoms making up the human body when they are subjected to a radiofrequency wave (= resonance) to produce cross-sectional images of organs and information about their composition.
Principle of the MRI examination: The person is placed inside a large magnet whose field will orient all the protons in the same direction. When the radiofrequency wave is stopped, the protons return to their initial disordered state, emitting a signal that is recorded. The time the proton takes to realign with the axis of the magnet is known as relaxation time T1; the time it takes to dephase again is the relaxation time T2. Depending on when the signal is picked up, a varying number of protons return to the equilibrium state whilst emitting a signal of varying intensity.

NVU: Neurovascular unit.

Parenchyma: Functional tissue of an organ, made up of cells with a given physiological activity, unlike the supportive connective tissue. (Cuvier, Anat. comp., t.4, 1805, p.4).

Proton (H+): Elementary particle in the atomic nucleus, positively electrically charged, equal in size to the electron, but with a mass approximately 1836 times greater. (J. Phys. et Radium, 1936, p. 241).

Relative risk: Ratio of the incidence of an illness in an exposed population over the incidence in those not exposed. It measures the increased risk of illness in exposed subjects compared to unexposed subjects; it is a measurement of the intensity of the relationship between the exposure factor and the illness.

R-tPA: Therapeutic method that consists of injecting a thrombolytic (or "fibrinolytic") substance, that is to say a substance capable of dissolving a blood clot.

Standardised Mortality Ratio (SMR): Ratio of observed deaths due to the illness studied and the expected number of deaths in the general population.

Stenosis: Obstruction of an artery due to a lesion on the wall of the vessel.

Thrombosis: A blood clot that forms in a vein or artery, which can lead to its being blocked.

Transient ischemic attack (TIA): A brief episode of neurological dysfunction caused by focal ischemia, in the brain or the retina, whose signs last less than one hour.

Vascular aneurysm: Dehiscence of an artery wall leading to localised dilation, or even rupture.

Sources: cntrl.fr (Cuvier, Anat. comp., t.4, 1805; J. Phys. et Radium,1936; G. GERARD, Anat. hum.,1912; Méd. Flamm.1975); Dr S. Gerber, GHPSL; Eurostat; Larousse; Larousse médical ; Solem; HAS; DCEM - Faculté de Médecine de Toulouse Purpan et Toulouse Rangueil; Module I «Apprentissage de l'exercice médical»; Sous module «La médecine fondée sur les preuves»; Quantification du Risque; Dr Catherine Arnaud, Pr Sandrine Andrieu (medecine.ups-tlse.fr/DCEM2/module1/sous_module1/004_risque_CA_SA.pdf).

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