Headache

Hope Through Research

National Institute of Neurological Disorders
and Stroke
National Institutes of Health

This pamphlet was written and published by the National Institute of Neurological Disorders and Stroke (NINDS), the United States' leading supporter of research on disorders of the brain and nerves, including headache. NINDS, one of the U.S. Government's National Institutes of Health in Bethesda, Maryland, is part of the Public Health Service within the U.S. Department of Health and Human Services.

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Introduction

For 2 years, Jim suffered the excruciating pain of cluster headaches. Night after night he paced the floor, the pain driving him to constant motion. He was only 48 years old when the clusters forced him to quit his job as a systems analyst. One year later, his headaches are controlled. The credit for Jim's recovery belongs to the medical staff of a headache clinic. Physicians there applied the latest research findings on headache, and prescribed for Jim a combination of new drugs.

Joan was a victim of frequent migraine. Her headaches lasted 2 days. Nauseous and weak, she stayed in the dark until each attack was over. Today, although migraine still interferes with her life, she has fewer attacks and less severe headaches than before. A specialist prescribed an antimigraine program for Joan that included improved drug therapy, a new diet and relaxation training.

An avid reader, Peggy couldn't put down the new mystery thriller. After 4 hours of reading slumped in bed, she knew she had overdone it. Her tensed head and neck muscles felt as if they were being squeezed between two giant hands. But for Peggy, the muscle-contraction headache and neck pain were soon relieved by a hot shower and aspirin.

An estimated 45 million Americans experience chronic headaches. For at least half of these people, the problem is severe and sometimes disabling. It can also be costly: headache sufferers make over 8 million visits a year to doctors' offices. Migraine victims alone lose over 157 million workdays because of headache pain.

"Some headaches require prompt medical attention."

Understanding why headaches occur and improving headache treatment are among the research goals of the National Institute of Neurological Disorders and Stroke (NINDS). As the leading supporter of brain research in the Federal Government, the NINDS also supports and conducts studies to improve the diagnosis of headaches and to find ways to prevent them.

Why Does it Hurt?

What hurts when you have a headache? Several areas of the head can hurt, including a network of nerves which extends over the scalp and certain nerves in the face, mouth, and throat. Also sensitive to pain, because they contain delicate nerve fibers, are the muscles of the head and blood vessels found along the surface and at the base of the brain.

The bones of the skull and tissues of the brain itself, however, never hurt, because they lack pain-sensitive nerve fibers.

The ends of these pain-sensitive nerves, called *nociceptors*, can be stimulated by stress, muscular tension, dilated blood vessels, and other triggers of headache. Once stimulated, a nociceptor sends a message up the length of the nerve fiber to the nerve cells in the brain, signaling that a part of the body hurts. The message is determined by the location of the nociceptor. A person who suddenly realizes "My toe hurts," is responding to nociceptors in the foot that have been stimulated by the stubbing of a toe.

A number of chemicals help transmit pain-related information to the brain. Some of these chemicals are natural painkilling proteins called *endorphins*, Greek for "the morphine within." One theory suggests that people who suffer from severe headache and other types of chronic pain have lower levels of endorphins than people who are generally pain free.

When Should You See a Physician?

Not all headaches require medical attention. Some result from missed meals or occasional muscle tension and are easily remedied. But some types of headache are signals of more serious disorders, and call for prompt medical care. These include:

- Sudden, severe headache
- Headache associated with convulsions
- Headache accompanied by confusion or loss of consciousness
- Headache following a blow on the head
- Headache associated with pain in the eye or ear
- Persistent headache in a person who was previously headache free
- Recurring headache in children
- Headache associated with fever
- Headache which interferes with normal life

A headache sufferer usually seeks help from a family practitioner. If the problem is not relieved by standard treatments, the patient may then be referred to a specialist — perhaps an internist or neurologist. Additional referrals may be made to psychologists.

What Tests are Used to Diagnose Headache?

Diagnosing a headache is like playing Twenty Questions. Experts agree that a detailed question-and-answer session with a patient can often produce enough information for a diagnosis. Many types of headaches have clear-cut symptoms which fall into an easily recognizable pattern.

Patients may be asked: How often do you have headaches? Where is the pain? How long do the headaches last? When did you first develop headaches? The patient's sleep habits and family and work situations may also be probed.

Most physicians will also obtain a full medical history from the patient, inquiring about past head trauma or surgery and about the use of medications. A blood test may be ordered to screen for thyroid disease, anemia, or infections which might cause a headache. X-rays may be taken to rule out the possibility of a brain tumor or blood clot.

A medical history often provides a physician with enough clues about a patient's headaches to make a diagnosis.

A test called an *electroencephalogram* (EEG) may be given to measure brain activity. EEG's can indicate a malfunction in the brain, but they cannot usually pinpoint a problem that might be causing a headache. A physician may suggest that a patient with unusual headaches

undergo a *computed tomographic (CT) scan* and/or *magnetic resonance imaging (MRI)*. The CT scan produces images of the brain that show structures or variations in the density of different types of tissue. The scan enables the physician to distinguish, for example, between a bleeding blood vessel in the brain and a brain tumor, and is an important diagnostic tool in cases of headache associated with brain lesions or other serious disease. MRI uses magnetic fields and radio waves to produce an image that provides information about the structure and biochemistry of the brain.

An eye exam is usually performed to check for weakness in the eye muscle or unequal pupil size. Both of these symptoms are evidence of an aneurysm — an abnormal ballooning of a blood vessel. A physician who suspects that a headache patient has an aneurysm may also order an *angiogram*. In this test, a special fluid which can be seen on an X-ray is injected into the patient and carried in the bloodstream to the brain to reveal any abnormalities in the blood vessels there.

Thermography, an experimental technique for diagnosing headache, promises to become a useful clinical tool. In thermography, an infrared camera converts skin temperature into a color picture or thermogram with different degrees of heat appearing as different colors. Skin temperature is affected primarily by blood flow. Research scientists have found that thermograms of headache patients show strikingly different heat patterns from those of people who never or rarely get headaches.

A physician analyzes the results of

Scientists at this clinic use thermography to diagnose headache. An infrared camera converts skin temperature, which is influenced by blood flow, into a color picture or thermogram. Each type of headache produces a distinctive heat pattern on a thermogram, so investigators can "see" their patients' headaches in living color.

all these diagnostic tests along with a patient's medical history in order to arrive at a diagnosis.

Headaches are diagnosed as

- Vascular
- Muscle contraction (tension)
- Traction
- Inflammatory

Vascular headaches — a group that includes the well-known *migraine* — are so named because they are thought to involve abnormal function of the brain's blood vessels or vascular system. Muscle contraction headaches appear to involve the tightening or tensing of facial and neck muscles. Traction and inflammatory headaches are symptoms of other disorders, ranging from stroke to sinus infection. Some people have more than one type of headache.

What are Migraine Headaches?

The most common type of vascular headache is migraine. Migraine headaches are usually characterized by severe pain on one or both sides of the head, an upset stomach, and at times disturbed vision.

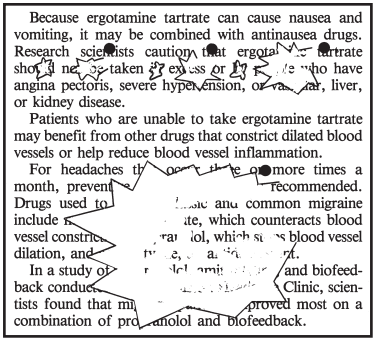
Former basketball star Kareem Abdul-Jabbar remembers experiencing his first migraine at age 14. The pain was unlike the discomfort of his previous mild headaches.

Migraine sufferer and former basketball star Kareem Abdul-Jabbar (holding a ball) played some of his best games after overcoming headache attacks.

"When I got this one I thought, '*This* is a headache'," he says. "The pain was intense and I felt nausea and a great sensitivity to light. All I could think about was when it would stop. I sat in a dark room for an hour and it passed."

Symptoms of migraine. Abdul-Jabbar's sensitivity to light is a standard symptom of the two most prevalent types of migraine-caused headache: classic and common.

The major difference between the two types is the appearance of neurological symptoms 10 to 30 minutes before a classic migraine attack. These symptoms are called an *aura*. The person may see flashing lights or zigzag lines, or may temporarily lose vision. Other classic symptoms include speech difficulty, weakness of an arm or leg, tingling of the face or hands, and confusion.



Because ergotamine tartrate can cause nausea and vomiting, it may be combined with antinausea drugs. Research scientists caution that ergotamine tartrate should not be taken in excess or by people who have angina pectoris, severe hypertension, or vascular, liver, or kidney disease.

Patients who are unable to take ergotamine tartrate may benefit from other drugs that constrict dilated blood vessels or help reduce blood vessel inflammation.

For headaches that occur three or more times a month, prevent[illegible] recommended. Drugs used to [illegible]ssic and common migraine include [illegible]ate, which counteracts blood vessel constric[illegible]ral[illegible]ol, which s[illegible]s blood vessel dilation, and [illegible]e, [illegible]a[illegible]t.

In a study of [illegible] and biofeedback conduc[illegible] Clinic, scientists found that mi[illegible] proved most on a combination of pro[illegible]anolol and biofeedback.

If you were about to experience a classic migraine headache, you might find it difficult to read this pamphlet. You could lose part of your vision temporarily and see zigzag lines and black dots. Such visual problems — and other neurological symptoms — often precede classic migraine.

The pain of a classic migraine headache is described as intense, throbbing, or pounding and is felt in the forehead, temple, ear, jaw, or around the eye. Classic migraine starts on one side of the head but may eventually spread to the other side. An attack lasts 1 to 2 pain-wracked days.

The common migraine — a term that reflects the disorder's greater occurrence in the general population — is not preceded by an aura. But some people experience a variety of vague symptoms beforehand, including mental fuzziness, mood changes, fatigue, and unusual retention of fluids. During the headache phase of a common migraine, a person may have diarrhea and increased urination, as well as nausea and vomiting. Common migraine pain can last 3 or 4 days.

"Migraines involve blood flow changes in the brain."

Both classic and common migraine can strike as often as several times a week, or as rarely as once every few years. Both types can occur at any time. Some people, however, experience migraines at predictable times — near the days of menstruation or every Saturday morning after a stressful week of work.

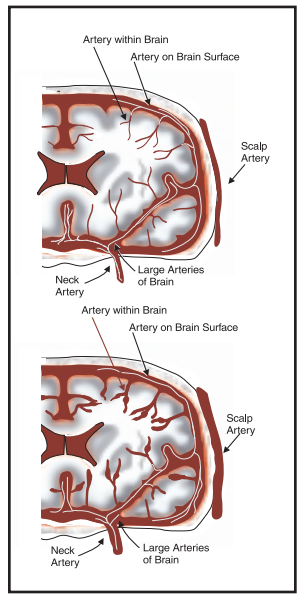
The migraine process. Research scientists are unclear about the precise cause of migraine headaches. There seems to be general agreement, however, that a key element is blood flow changes in the brain. People who get migraine headaches appear to have blood vessels that overreact to various triggers.

Scientists have devised one theory of migraine which explains these blood flow changes and also certain biochemical changes that may be involved in the headache process. According to this theory, the nervous system responds to a trigger such as stress by creating a spasm in the nerve-rich arteries at the base of the brain. The spasm closes down or constricts several arteries supplying blood to the brain, including the scalp artery and the carotid or neck arteries.

As these arteries constrict, the flow of blood to the brain is reduced. At the same time, blood-clotting particles called platelets clump together — a process which is believed to release a chemical called *serotonin*. Serotonin acts as a powerful constrictor of arteries, further reducing the blood supply to the brain.

Reduced blood flow decreases the brain's supply of oxygen. Symptoms signaling a headache, such as distorted vision or speech, may then result, similar to symptoms of stroke.

Reacting to the reduced oxygen supply, certain arteries within the brain open wider to meet the brain's energy needs. This widening or dilation spreads, finally affecting the neck and scalp arteries. The dilation of these arteries triggers the release of pain-producing substances called *prostaglandins* from various tissues and blood cells. Chemicals which cause inflammation and swelling and substances which increase sensitivity to pain are also released. The circulation of these chemicals and the dilation of the scalp arteries stimulate the pain-sensitive nociceptors. The result, according to this theory: a throbbing pain in the head.



One theory of the migraine process: (a) a patient's nervous system responds to a trigger such as stress by creating a spasm in the arteries at the base of the brain. The spasm and the release of serotonin reduce blood flow to the brain. Blood-borne oxygen is decreased, causing the "aura" of neurological symptoms; (b) arteries in and around brain tissue then dilate or widen to meet the brain's energy and oxygen needs. Pain-producing chemicals are released and nerve endings on the scalp are stimulated. The patient then feels a throbbing pain in the head.

Women and migraine. Although both males and females seem to be equally affected by migraine, the condition is more common in adult women. Both sexes may develop migraine in infancy, but most often the disorder begins between the ages of 5 and 35.

The relationship between female hormones and migraine is still unclear. Women may have "menstrual migraine" — headaches around the time of their menstrual period — which may disappear during pregnancy. Other women develop migraine for the first time when they are pregnant. Some are first affected after menopause.

The effect of oral contraceptives on headaches is perplexing. Scientists report that some women with migraine who take birth control pills experience more frequent and severe attacks. However, a small percentage of women have fewer and less severe migraine headaches when they take birth control pills. And normal women who do not suffer from headaches may develop migraines as a side effect when they use oral contraceptives. Investigators around the world are studying hormonal changes in women with migraine in the hope of identifying the specific ways these naturally occurring chemicals cause headaches.

Triggers of headache. Although many sufferers have a family history of migraine, the exact hereditary nature of this condition is still unknown. People who get migraines are thought to have an inherited abnormality in the regulation of blood vessels.

"It's like a cocked gun with a hair trigger," explains one specialist. "A person is born with a potential for migraine and the headache is triggered by things that are really not so terrible."

These triggers include stress and other normal emotions, as well as biological and environmental conditions. Fatigue, glaring or flickering lights, the weather, and certain foods can set off migraine. It may seem hard to believe that eating such seemingly harmless foods as yogurt, nuts, and lima beans can result in a painful migraine headache. However, some scientists believe that these foods and several others contain chemical substances, such as tyramine, which constrict arteries — the first step of the migraine process. Other scientists believe that foods cause headaches by setting off an allergic reaction in susceptible people.

"Migraine is triggered by things that are not so terrible."

While a food-triggered migraine usually occurs soon after eating, other triggers may not cause immediate pain. Scientists report that people can develop migraine not only during a period of stress but also afterwards when their vascular systems are still reacting. For example, migraines that wake people up in the middle of the night are believed to result from a delayed reaction to stress.

Other forms of migraine. In addition to classic and common, migraine headache can take several other forms:

Patients with *hemiplegic migraine* have temporary paralysis on one side of the body, a condition

known as hemiplegia. Some people may experience vision problems and vertigo — a feeling that the world is spinning. These symptoms begin 10 to 90 minutes before the onset of headache pain.

In *ophthalmoplegic migraine*, the pain is around the eye and is associated with a droopy eyelid, double vision, and other sight problems.

Basilar artery migraine involves a disturbance of a major brain artery. Preheadache symptoms include vertigo, double vision, and poor muscular coordination. This type of migraine occurs primarily in adolescent and young adult women and is often associated with the menstrual cycle.

Benign exertional headache is brought on by running, lifting, coughing, sneezing, or bending. The headache begins at the onset of activity, and pain rarely lasts more than several minutes.

Status migrainosus is a rare and severe type of migraine that can last 72 hours or longer. The pain and nausea are so intense that people who have this type of headache must be hospitalized. The use of certain drugs can trigger status migrainosus. Neurologists report that many of their status migrainosus patients were depressed and anxious before they experienced headache attacks.

Headache-free migraine is characterized by such migraine symptoms as visual problems, nausea, vomiting, constipation, or diarrhea. Patients, however, do not experience head pain. Headache specialists have suggested that unexplained pain in a particular part of the body, fever, and dizziness could also be possible types of headache-free migraine.

How is Migraine Headache Treated?

During the Stone Age, pieces of a headache sufferer's skull were cut away with flint instruments to relieve pain. Another unpleasant remedy used in the British Isles around the ninth century involved drinking "the juice of elderseed, cow's brain, and goat's dung dissolved in vinegar." Fortunately, today's headache patients are spared such drastic measures.

Drug therapy, biofeedback training, stress reduction, and elimination of certain foods from the diet are the most common methods of preventing and controlling migraine and other vascular headaches. Joan, the migraine sufferer, was helped by treatment with a combination of an antimigraine drug and diet control.

Regular exercise, such as swimming or vigorous walking, can also reduce the frequency and severity of migraine headaches. Joan found that yoga and whirlpool baths helped her relax.

During a migraine headache, temporary relief can sometimes be obtained by using cold packs or by pressing on the bulging artery found in front of the ear on the painful side of the head.

Common sense rather than scientific discovery was the basis of many early migraine remedies. This 19th century French cartoon shows a family responding to the needs of a migraine sufferer by creating a dark, quiet atmosphere.

Drug therapy. There are two ways to approach the treatment of migraine headache with drugs: prevent the attacks, or relieve symptoms after the headache occurs.

For infrequent migraine, drugs can be taken at the first sign of a headache in order to stop it or to at least ease the pain. People who get occasional mild migraine may benefit by taking aspirin or acetaminophen at the start of an attack. Aspirin raises a person's tolerance to pain and also discourages clumping of blood platelets. Small amounts of caffeine may be useful if taken in the early stages of migraine. But for most migraine sufferers who get moderate to severe headaches, and for all cluster patients, stronger drugs may be necessary to control the pain.

"With biofeedback, migraine may become less frequent."

One of the most commonly used drugs for the relief of classic and common migraine symptoms is *ergotamine tartrate*, a vasoconstrictor which helps counteract the painful dilation stage of the headache. For optimal benefit, the drug is taken during the early stages of an attack. If a migraine has been in progress for about an hour and has passed into the final throbbing stage, ergotamine tartrate will probably not help.

Because ergotamine tartrate can cause nausea and vomiting, it may be combined with antinausea drugs. Research scientists caution that ergotamine tartrate should not be taken in excess or by people who have angina pectoris, severe hypertension, or vascular, liver, or kidney disease.

Patients who are unable to take ergotamine tartrate may benefit from other drugs that constrict dilated blood vessels or help reduce blood vessel inflammation.

For headaches that occur three or more times a month, preventive treatment is usually recommended. Drugs used to prevent classic and common migraine include methysergide maleate, which counteracts blood vessel constriction; propranolol hydrochloride, which stops blood vessel dilation; and amitriptyline, an antidepressant.

Antidepressants called MAO inhibitors also prevent migraine. These drugs block an enzyme called monoamine oxidase which normally helps nerve cells absorb the artery-constricting brain chemical, serotonin.

MAO inhibitors can have potentially serious side effects — particularly if taken while ingesting foods or beverages that contain tyramine, a substance that constricts arteries.

Several drugs for the prevention of migraine have been developed in recent years, including serotonin agonists which mimic the action of this key brain chemical. Prompt administration of these drugs is important.

Many antimigraine drugs can have adverse side effects. But like most medicines they are relatively safe when used carefully and under a physician's supervision. To avoid long-term side effects of preventive medications, headache specialists advise patients to reduce the dosage of these drugs and then to stop taking them as soon as possible.

Biofeedback and relaxation training. Drug therapy for migraine is often combined with biofeedback and relaxation training. Biofeedback refers to a technique that can give people better control over such body function indicators as blood pressure, heart rate, temperature, muscle tension, and brain waves. *Thermal biofeedback* allows a patient to consciously raise hand temperature. Some patients who are able to increase hand temperature can reduce the number and intensity of migraines. The mechanisms underlying these self-regulation treatments are being studied by research scientists.

"To succeed in biofeedback," says a headache specialist, "you must be able to concentrate and you must be motivated to get well."

A patient learning thermal biofeedback wears a device which transmits the temperature of an index finger or hand to a monitor. While the patient tries to warm his hands, the monitor provides feedback either on a gauge that shows the temperature reading or by emitting a sound or beep that increases in intensity as the temperature increases. The patient is not told how to raise hand temperature, but is given suggestions such as "Imagine that your hands feel very warm and heavy."

A scientist instructs a headache patient in thermal biofeedback. A temperature-sensitive device attached to her forefinger is connected to a feedback meter that tells the patient if and how much she is warming her hands.

"I have a good imagination," says one headache sufferer who traded in her medication for thermal biofeedback. The technique decreased the number and severity of headaches she experienced.

In another type of biofeedback called *electromyographic* or *EMG training*, the patient learns to control muscle tension in the face, neck, and shoulders.

Either kind of biofeedback may be combined with relaxation training, during which patients learn to relax the mind and body.

Biofeedback can be practiced at home with a portable monitor. But the ultimate goal of treatment is to wean the patient from the machine. The patient can then use biofeedback anywhere at the first sign of a headache.

The antimigraine diet. Scientists estimate that a small percentage of migraine sufferers will benefit from a treatment program focused solely on eliminating headache-provoking foods and beverages.

Other migraine patients may be helped by a diet to prevent low blood sugar. Low blood sugar, or hypoglycemia, can cause dilation of the blood vessels in the head. This condition can occur after a period without food: overnight, for example, or when a meal is skipped. People who wake up in the morning with a headache may be reacting to the low blood sugar caused by the lack of food overnight.

Treatment for headaches caused by low blood sugar consists of scheduling smaller, more frequent meals for the patient. A special diet designed to stabilize the body's sugar-regulating system is sometimes recommended.

For the same reason, many specialists also recommend that migraine patients avoid oversleeping on weekends. Sleeping late can change the body's normal blood sugar level and lead to a headache.

Besides Migraine, What are Other Types of Vascular Headaches?

After migraine, the most common type of vascular headache is the toxic headache produced by fever. Pneumonia, measles, mumps, and tonsillitis are among the diseases that can cause severe toxic vascular headaches. Toxic headaches can also result from the presence of foreign chemicals in the body. Other kinds of vascular headaches include "*clusters*," which cause repeated episodes of intense pain, and headaches resulting from a rise in blood pressure.

Chemical culprits. Repeated exposure to nitrite compounds can result in a dull, pounding headache that may be accompanied by a flushed face. Nitrite, which dilates blood vessels, is found in such products as heart medicine and dynamite, but is also used as a chemical to preserve meat. Hot dogs and other processed meats containing sodium nitrite can cause headaches.

Eating foods prepared with monosodium glutamate (MSG) can result in headache. Soy sauce, meat tenderizer, and a variety of packaged foods contain this chemical which is touted as a flavor enhancer.

Headache can also result from exposure to poisons, even common household varieties like insecticides, carbon tetrachloride, and lead. Children who injest flakes of lead paint may develop headaches. So may anyone who has contact with lead batteries or lead-glazed pottery.

Artists and industrial workers may experience headaches after exposure to materials that contain chemical solvents. Solvents, like benzene, are found in turpentine, spray adhesives, rubber cement, and inks.

Drugs such as amphetamines can cause headaches as a side effect. Another type of drug-related headache occurs during withdrawal from long-term therapy with the antimigraine drug ergotamine tartrate.

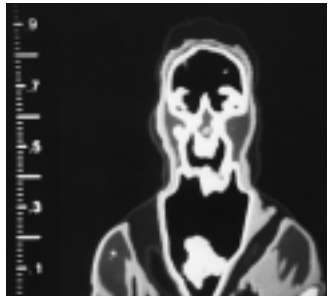
Jokes are often made about alcohol hangovers but the headache associated with "the morning after" is no laughing matter. Fortunately, there are several suggested remedies for the pain, including ergotamine tartrate. The hangover headache may also be reduced by taking honey, which speeds alcohol metabolism, or caffeine, a constrictor of dilated arteries. Caffeine, however, can cause headaches as well as cure them. Heavy coffee drinkers often get headaches when they try to break the caffeine habit.

Cluster headaches. Cluster headaches, named for their repeated occurrence in groups or clusters, begin as a minor pain around one eye, eventually spreading to that side of the face. The pain quickly intensifies, compelling the victim to pace the floor or rock in a chair. "You can't lie down, you're fidgety," explains a cluster patient. "The pain is unbearable." Other symptoms include a stuffed and runny nose and a droopy eyelid over a red and tearing eye.

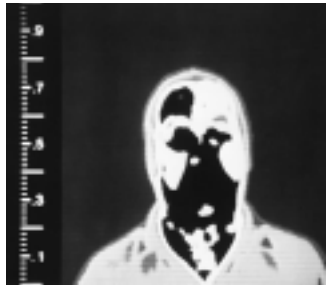
"The typical cluster patient is tall and muscular."

Cluster headaches last between 30 and 45 minutes. But the relief people feel at the end of an attack is usually mixed with dread as they await a recurrence. Clusters can strike several times a day or night for several weeks or months. Then, mysteriously, they may disappear for months or years. Many people have cluster bouts during the spring and fall. At their worst, chronic cluster headaches can last continuously for years.

Cluster attacks can strike at any age but usually start between the ages of 20 and 40. Unlike migraine, cluster headaches are more common in men and do not run in families. Research scientists have observed certain physical similarities among people who experience cluster headache. The typical cluster patient is a tall, muscular man with a ragged facial appearance and a square, jutting or dimpled chin. The texture of his coarse skin resembles an orange peel. Women who get clusters may also have this type of skin.



A thermogram of a normal person shows a symmetrical heat pattern on the individual's forehead.



A cluster headache patient's thermogram shows a cold area (appears white) of reduced blood flow on the left side of the forehead.

Studies of cluster patients show that they are likely to have hazel eyes and that they tend to be heavy smokers and drinkers. Paradoxically, both nicotine, which constricts arteries, and alcohol, which

dilates them, trigger cluster headaches. The exact connection between these substances and cluster attacks is not known.

Despite a cluster headache's distinguishing characteristics, its relative infrequency and similarity to such disorders as *sinusitis* can lead to misdiagnosis. Some cluster patients have had tooth extractions, sinus surgery, or psychiatric treatment in futile efforts to cure their pain.

Research studies have turned up several clues as to the cause of cluster headache, but no answers. One clue is found in the thermograms of untreated cluster patients, which show a "cold spot" of reduced blood flow above the eye.

The sudden start and brief duration of cluster headaches can make them difficult to treat; however, research scientists have identified several effective drugs for these headaches. The antimigraine drug ergotamine tartrate can subdue a cluster, if taken at the first sign of an attack. Injections of *dihydroergotamine*, a form of ergotamine tartrate, are sometimes used to treat clusters.

Some cluster patients can prevent attacks by taking propranolol or methysergide. Investigators have also discovered that mild solutions of cocaine hydrochloride applied inside the nose can quickly stop cluster headaches in most patients. This treatment may work because it both blocks pain impulses and constricts blood vessels.

Another option that works for some cluster patients is rapid inhalation of pure oxygen through a mask for 5 to 15 minutes. The oxygen seems to ease the pain of cluster headache by reducing blood flow to the brain.

In chronic cases of cluster headache, certain facial nerves may be surgically cut or destroyed to provide relief. These procedures have had limited success. Some cluster patients have had facial nerves cut only to have them regenerate years later.

Painful pressure. Chronic high blood pressure can cause headache, as can rapid rises in blood pressure like those experienced during anger, vigorous exercise, or sexual excitement.

The severe "orgasmic headache" occurs right before orgasm and is believed to be a vascular headache. Since sudden rupture of a cerebral blood vessel can occur, this type of headache should be evaluated by a doctor.

What are Muscle-Contraction Headaches?

It's 5:00 p.m. and your boss has just asked you to prepare a 20-page briefing paper. Due date: tomorrow. You're angry and tired and the more you think about the assignment, the tenser you become. Your teeth clench, your brow wrinkles, and soon you have a splitting tension headache.

Tension headache is named not only for the role of stress in triggering the pain, but also for the contraction of neck, face, and scalp muscles brought on by stressful events. Tension headache is a severe but temporary form of muscle-contraction headache. The pain is mild to moderate and feels like pressure is being applied to the head or neck. The headache usually disappears after the period of stress is over. Ninety percent of all headaches are classified as tension/muscle-contraction headaches.

By contrast, chronic muscle-contraction headaches can last for weeks, months, and sometimes years. The pain of these headaches is often described as a tight band around the head or a feeling that the head and neck are in a cast. "It feels like somebody is tightening a giant vise around my head," says one patient. The pain is steady, and is usually felt on both sides of the head. Chronic muscle-contraction headaches can cause sore scalps — even combing one's hair can be painful.

Many scientists believe that the primary cause of the pain of muscle-contraction headache is sustained muscle tension. Other studies suggest that restricted blood flow may cause or contribute to the pain.

Occasionally, muscle-contraction headaches will be accompanied by nausea, vomiting, and blurred vision, but there is no preheadache syndrome as with migraine. Muscle-contraction headaches have not been linked to hormones or foods, as has migraine, nor is there a strong hereditary connection.

Research has shown that for many people, chronic muscle-contraction headaches are caused by depression and anxiety. These people tend to get their headaches in the early morning or evening when conflicts in the office or home are anticipated.

Tension headaches are named not only for the role of stress in triggering the pain, but also for the contraction of neck, face, and scalp muscles brought on by stressful events. These headaches usually disappear after the stress is over.

Emotional factors are not the only triggers of muscle-contraction headaches. Certain physical postures that tense head and neck muscles — such as holding one's chin down while reading — can lead to head and neck pain. So can prolonged writing under poor light, or holding a phone between the shoulder and ear, or even gum-chewing.

More serious problems that can cause muscle-contraction headaches include degenerative arthritis of the neck and *temporomandibular joint dysfunction*, or TMD. TMD is a disorder of the joint between the temporal bone (above the ear) and the mandible or lower jaw bone. The disorder results from poor bite and jaw clenching.

Treatment for muscle-contraction headache varies. The first consideration is to treat any specific disorder or disease that may be causing the headache. For example, arthritis of the neck is treated with anti-inflammatory medication and TMD may be helped by corrective devices for the mouth and jaw.

Acute tension headaches not associated with a disease are treated with muscle relaxants and analgesics like aspirin and acetaminophen. Stronger analgesics, such as propoxyphene and codeine, are sometimes prescribed. As prolonged use of these drugs can lead to dependence, patients taking them should have periodic medical checkups and follow their physicians' instructions carefully.

Nondrug therapy for chronic muscle-contraction headaches includes biofeedback, relaxation training, and counseling. A technique called cognitive restructuring teaches people to change their attitudes and responses to stress. Patients might be encouraged, for example, to imagine that they are coping successfully with a stressful situation. In progressive relaxation therapy, patients are taught to first tense and then relax individual muscle groups. Finally, the patient tries to relax his or her whole body. Many people imagine a peaceful scene — such as lying on the beach or by a beautiful lake. Passive relaxation does not involve tensing of muscles. Instead, patients are encouraged to focus on different muscles, suggesting that they relax. Some people might think to themselves, *Relax* or *My muscles feel warm*.

People with chronic muscle-contraction headaches may also be helped by taking antidepressants or MAO inhibitors. Mixed muscle-contraction and migraine headaches are sometimes treated with barbiturate compounds, which slow down nerve function in the brain and spinal cord.

People who suffer infrequent muscle-contraction headaches may benefit from a hot shower or moist heat applied to the back of the neck. Cervical collars are sometimes recommended as an aid to good posture. Physical therapy, massage, and gentle exercise of the neck may also be helpful.

When is Headache a Warning of a More Serious Condition?

Like other types of pain, headaches can serve as warning signals of more serious disorders. This is particularly true for headaches caused by traction or inflammation.

Traction headaches can occur if the pain-sensitive parts of the head are pulled, stretched, or displaced, as, for example, when eye muscles are tensed to compensate for eyestrain. Headaches caused by *inflammation* include those related to meningitis as well as those resulting from diseases of the sinuses, spine, neck, ears, and teeth. Ear and tooth infections and glaucoma can cause headaches. In oral and dental disorders, headache is experienced as pain in the entire head, including the face.

Traction and inflammatory headaches are treated by curing the underlying problem. This may involve surgery, antibiotics or other drugs.

Characteristics of the various types of traction and inflammatory headaches vary by disorder:

This research patient is rating the intensity of heat-induced acute pain transmitted by electrodes. From her ratings, investigators hope to determine whether a chronic pain drug she is taking for facial pain and headache is effective against acute pain.

- ***Brain tumor.*** Brain tumors are diagnosed in about 11,000 people every year. As they grow, these tumors sometimes cause headache by pushing on the outer layer of nerve tissue that covers the brain or by pressing against pain-sensitive blood vessel walls. Headache resulting from a brain tumor may be periodic or continuous.

Typically, it feels like a strong pressure is being applied to the head. The pain is relieved when the tumor is destroyed by surgery, radiation, or chemotherapy.

• ***Stroke.*** Headache may accompany several conditions that can lead to stroke, including hypertension or high blood pressure, arteriosclerosis, and heart disease. Headaches are also associated with completed stroke, when brain cells die from lack of sufficient oxygen.

Many stroke-related headaches can be prevented by careful management of the patient's condition through diet, exercise, and medication.

Mild to moderate headaches are associated with transient ischemic attacks (TIAs), sometimes called "mini-strokes," which result from a temporary lack of blood supply to the brain. The head pain occurs near the clot or lesion that blocks blood flow. The similarity between migraine and symptoms of TIA can cause problems in diagnosis. The rare person under age 40 who suffers a TIA may be misdiagnosed as having migraine; similarly, TIA-prone older patients who suffer migraine may be misdiagnosed as having stroke-related headaches.

• ***Spinal tap.*** About one-fourth of the people who undergo a lumbar puncture or spinal tap develop a headache. Many scientists believe these headaches result from leakage of the cerebrospinal fluid that flows through pain-sensitive membranes around the brain and down to the spinal cord. The fluid, they suggest, drains through the tiny hole created by the spinal tap needle, causing the

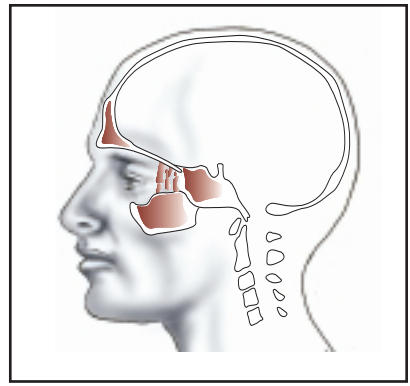
membranes to rub painfully against the bony skull. Since headache pain occurs only when the patient stands up, the "cure" is to remain lying down until the headache runs its course — anywhere from a few hours to several days.

• ***Head trauma.*** Headaches may develop after a blow to the head, either immediately or months later. There is little relationship between the severity of the trauma and the intensity of headache pain. One cause of trauma headache is scar formation in the scalp. Another is ruptured blood vessels which result in an accumulation of blood called a hematoma. This mass of blood can displace brain tissue and cause headaches as well as weakness, confusion, memory loss, and seizures. Hematomas can be drained to produce rapid relief of symptoms.

• ***Arteritis and meningitis.*** Arteritis, an inflammation of certain arteries in the head, primarily affects people over age 50. Symptoms include throbbing headache, fever, and loss of appetite. Some patients experience blurring or loss of vision. Prompt treatment with corticosteroid drugs helps to relieve symptoms.

Headaches are also caused by infections of meninges, the brain's outer covering, and phlebitis, a vein inflammation.

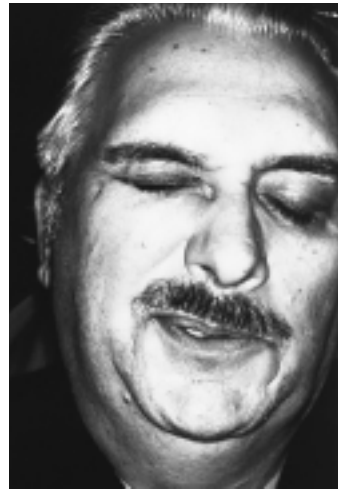
• ***Trigeminal neuralgia.*** Trigeminal neuralgia, or tic douloureux, results from a disorder of the trigeminal nerve. This nerve supplies the face, teeth, mouth, and nasal cavity with feeling and also enables the mouth muscles to chew. Symptoms are headache and intense facial pain that



Acute sinusitis headaches can occur when one or all four of the sinus cavities fill with bacterial or viral fluid. The particular cavity affected determines the location of the sinus headache.

comes in short, excruciating jabs set off by the slightest touch to or movement of trigger points in the face or mouth. People with trigeminal neuralgia often fear brushing their teeth or chewing on the side of the mouth that is affected. Many trigeminal neuralgia patients are controlled with drugs, including carbamazepine. Patients who do not respond to drugs may be helped by surgery on the trigeminal nerve.

• ***Sinus infection.*** In a condition called acute sinusitis, a viral or bacterial infection of the upper respiratory tract spreads to the membrane which lines the sinus cavities. When one or all four of these cavities are filled with bacterial or viral fluid, they become inflamed, causing pain and sometimes headache. Treatment of acute sinusitis includes antibiotics, analgesics, and decongestants. Chronic sinusitis may be caused by an allergy to such irritants as dust, ragweed, animal hair, and smoke. Research scientists disagree about whether chronic sinusitis triggers headache.



A patient in the throes of a trigeminal neuralgia attack feels sudden, violent jabs of pain in the face, mouth, and head.

What Causes Headache in Children?

Like adults, children experience the infections, trauma, and stresses that can lead to headaches. In fact, research shows that as young people enter adolescence and encounter the stresses of puberty and secondary school, the frequency of headache increases.

Migraine headaches often begin in childhood or adolescence. According to recent surveys, as many as half of all schoolchildren experience some type of headache.

Children with migraine often have nausea and excessive vomiting. Some children have periodic vomiting, but no headache — the so-called "abdominal migraine." Research scientists have found that these children usually develop headaches when they are older.

Physicians have many drugs to treat migraine in children. Different classes that may be tried include analgesics, antiemetics, anticonvulsants, beta-blockers, and sedatives. A diet may also be prescribed to protect the child from foods that trigger headache. Sometimes psychological counseling or even psychiatric treatment for the child and the parents is recommended.

This child has a good chance of controlling her headaches with thermal biofeedback therapy, say NINDS-supported scientists conducting migraine research.

Childhood headache can be a sign of depression. Parents should alert the family pediatrician if a child develops headaches along with other symptoms such as a change in mood or sleep habits. Antidepressant medication and psychotherapy are effective treatments for childhood depression and related headache.

"About 90 percent of chronic headache patients can be helped."

Conclusion

If you suffer from headaches and none of the standard treatments help, do not despair. Some people find that their headaches disappear once they deal with a troubled marriage, pass their law board exams, or resolve some other stressful problem. Others find that if they control their psychological reaction to stress, the headaches disappear.

"I had migraines for several years," says one woman, "and then they went away. I think it was because I lowered my personal goals in life. Today, even though I have 100 things to do at night, I don't worry about it. I learned to say no."

For those who cannot say no, or who get headaches anyway, today's headache research offers hope. The work of NINDS-supported scientists around the world promises to improve our understanding of this complex disorder and provide better tools to treat it.

Glossary

angiography — an imaging technique that provides a picture, called an **angiogram**, of blood vessels.

aura — a symptom of classic migraine headache in which the patient sees flashing lights or zigzag lines, or may temporarily lose vision.

basilar artery migraine — migraine, occurring primarily in young women and often associated with the menstrual cycle, that involves a disturbance of a major brain artery. Symptoms include vertigo, double vision, and poor muscular coordination.

benign exertional headache — headache brought on by running, lifting, coughing, sneezing, or bending.

biofeedback — a technique in which patients are trained to gain some voluntary control over certain physiological conditions, such as blood pressure and muscle tension, to promote relaxation. **Thermal biofeedback** helps patients consciously raise hand temperature, which can sometimes reduce the number and intensity of migraines.

cluster headaches — intensely painful headaches — occurring suddenly and lasting between 30 and 45 minutes — named for their repeated occurrence in groups or clusters. They begin as minor pain around one eye and eventually spread to that side of the face.

computer tomography (CT) — an imaging technique that uses X-rays and computer analysis to provide a picture of body tissues and structures.

dihydroergotamine — a drug that is given by injection to treat cluster headaches. It is a form of the antimigraine drug ergotamine tartrate.

electroencephalogram (EEG) — a technique for recording electrical activity in the brain.

electromyography (EMG) — a special recording technique that detects electric activity in muscle. Patients are sometimes offered a type of biofeedback called **EMG training**, in which they learn to control muscle tension in the face, neck, and shoulders.

endorphins — naturally occurring painkilling chemicals. Some scientists theorize that people who suffer from severe headache have lower levels of endorphins than people who are generally pain free.

ergotamine tartrate — a drug that is used to control the painful dilation stage of migraine.

hemiplegic migraine — a type of migraine causing temporary paralysis on one side of the body (**hemiplegia**).

inflammatory headache — a headache that is a symptom of another disorder, such as sinus infection, and is treated by curing the underlying problem.

magnetic resonance imaging (MRI) — an imaging technique that uses radio waves, magnetic fields, and computer analysis to provide a picture of body tissues and structures.

migraine — a vascular headache believed to be caused by blood flow changes and certain chemical changes in the brain leading to a cascade of events — including constriction of arteries supplying blood to the brain and the release of certain brain chemicals — that result in severe head pain, stomach upset, and visual disturbances.

muscle-contraction headaches — headaches caused primarily by sustained muscle tension or, possibly, by restricted blood flow to the brain. Two forms of muscle-contraction headache are **tension headache**, induced by stress, and **chronic muscle-contraction headache**, which can last for extended periods, involves steady pain, and is usually felt on both sides of the head.

nociceptors — the endings of pain-sensitive nerves that, when stimulated by stress, muscular tension, dilated blood vessels, or other triggers, send messages up the nerve fibers to nerve cells in the brain, signaling that a part of the body hurts.

ophthalmoplegic migraine — a form of migraine felt around the eye and associated with a droopy eyelid, double vision, and other sight problems.

prostaglandins — naturally occurring pain-producing substances thought to be implicated in migraine attacks. Their release is triggered by the dilation of arteries. Prostaglandins are extremely potent chemicals involved in a diverse group of physiological processes.

serotonin — a key neurotransmitter that acts as a powerful constrictor of arteries, reducing the blood supply to the brain and contributing to the pain of headache.

sinusitis — an infection, either viral or bacterial, of the sinus cavities. The infection leads to inflammation of these cavities, causing pain and sometimes headache.

status migrainosus — a rare, sustained, and severe type of migraine, characterized by intense pain and nausea and often leading to hospitalization of the patient.

thermography — a technique sometimes used for diagnosing headache in which an infrared camera converts skin temperature into a color picture, called a **thermogram**, with different degrees of heat appearing as different colors.

temporomandibular joint dysfunction — a disorder of the joint between the temporal bone (above the ear) and the lower jaw bone that can cause muscle-contraction headaches.

tic douloureux — *see* trigeminal neuralgia

traction headaches — headaches caused by pulling or stretching pain-sensitive parts of the head, as, for example, when eye muscles are tensed to compensate for eyestrain.

trigeminal neuralgia — a condition resulting from a disorder of the trigeminal nerve. Symptoms are headache and intense facial pain that comes in short, excruciating jabs.

vascular headaches — headaches caused by abnormal function of the brain's blood vessels or vascular system. Migraine is a type of vascular headache.

Credits

Illustrations and photos:

Original painting by Nan Quintin for "Through the Looking Glass" Headache Art Exhibition, courtesy of Sandoz Pharmaceuticals Corp. — cover
William Branson, NIH — pages 6, 8
Associated Press/Wide World Photos, Inc. — page 9 (upper)
Adapted from Oliver W. Sacks, *Migraine, The Evolution of a Common Disorder*, 1970, University of California Press — page 9 (lower)
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William K. Geiger, for NINDS — page 25
John Crawford, NIH — page 28
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National Institute of Dental and Craniofacial Research — page 31 (lower)

Information Resources

NIH Neurological Institute
P.O. Box 5801
Bethesda, MD 20824
(301) 496-5751
(800) 352-9424

The National Institute of Neurological Disorders and Stroke, a component of the National Institutes of Health, is the leading Federal supporter of research on disorders of the brain and nervous system. The Institute also sponsors an active public information program and can answer questions about diagnosis, treatment, and research related to headache.

Private voluntary organizations that offer information and services to those affected by headache include the following:

American Council for Headache Education (ACHE)
875 Kings Highway
Suite 200
Woodbury, NJ 08096
(609) 384-8760
(800) 255-ACHE (2243)
http://www.achenet.org

This organization is a nonprofit patient/health professional partnership dedicated to advancing treatment and management of headache and to raising the public awareness of headache as a valid, biologically based illness. ACHE offers headache brochures, a quarterly newsletter, the book *Migraine: The Complete Guide*, assistance through in-person support groups, and support via the Internet and commercial on-line service providers.

National Headache Foundation
428 West St. James Place
2nd Floor
Chicago, IL 60614-2750
(312) 388-6399
(888) 643-5552

The foundation promotes research and public education, publishes a quarterly newsletter, and offers many publications including a state-by-state list of physician members, a headache chart, a handbook, brochures, and fact sheets.

"Headache: Hope Through Research," 2002, NINDS

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Office of Communications and Public Liaison
National Institute of Neurological Disorders and Stroke
National Institutes of Health
Bethesda, MD 20892

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