

Headache



National Institute of Neurological Disorders
and Stroke
National Institutes of Health

Hope Through Research

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 nervous system, 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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This brochure has been designed to help you better understand headaches and how they are treated. Knowing about headaches will make it easier for you to discuss your symptoms and concerns with your doctor.

Introduction

You're sitting at your desk, working on a difficult task, when it suddenly feels as if a belt or vice is being tightened around the top of your head. Or you have periodic headaches that occur with nausea and increased sensitivity to light or sound. Maybe you are involved in a routine, non-stressful task when you're struck by head or neck pain.



Headaches are the most common form of pain and range in frequency and severity. Without proper treatment headaches can interfere with daily activities.

Sound familiar? If so, you've suffered one of the many types of headache that can occur on its own or as part of another disease or health condition.

Anyone can experience a headache. Nearly 2 out of 3 children will have

a headache by age 15. More than 9 in 10 adults will experience a headache sometime in their life. Headache is our most common form of pain and a major reason cited for days missed at work or school as well as visits to the doctor. Without proper treatment, headaches can be severe and interfere with daily activities.

Certain types of headache run in families. Episodes of headache may ease or even disappear for a time and recur later in life. It's possible to have more than one type of headache at the same time.

*Primary headaches*¹ occur independently and are not caused by another medical condition. It's uncertain what sets the process of a primary headache in motion. A cascade of events that affect blood vessels and nerves inside and outside the head causes pain signals to be sent to the brain. Brain chemicals called *neurotransmitters* are involved in creating head pain, as are changes in nerve cell activity (called *cortical spreading depression*). Migraine, cluster, and tension-type headache are the more familiar types of primary headache.

Secondary headaches are symptoms of another health disorder that causes pain-sensitive nerve endings to be pressed on or pulled or pushed out of place. They may result from underlying conditions including fever, infection, medication overuse, stress or emotional conflict, high blood pressure, psychiatric disorders, head injury or trauma, stroke, tumors, and nerve disorders (particularly trigeminal neuralgia, a chronic pain condition that typically affects a major nerve on one side of the jaw or cheek).

Headaches can range in frequency and severity of pain. Some individuals may experience headaches once or twice a year, while others may experience headaches more than 15 days a month. Some headaches may recur or last for weeks at a time. Pain can range from mild to disabling and may be accompanied by symptoms such as nausea or increased sensitivity to noise or light, depending on the type of headache.

¹ Words in italics appear in the Glossary found at the end of this document.

Why Headaches Hurt

Information about touch, pain, temperature, and vibration in the head and neck is sent to the brain by the trigeminal nerve, one of 12 pairs of cranial nerves that start at the base of the brain. The nerve has three branches that conduct sensations from the scalp, the blood vessels inside and outside of the skull, the lining around the brain (the *meninges*), and the face, mouth, neck, ears, eyes, and throat.

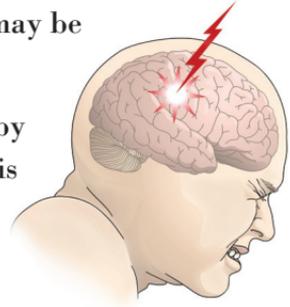
Headaches can signal a more serious disorder that requires prompt medical care.

Brain tissue itself lacks pain-sensitive nerves and does not feel pain. Headaches occur when pain-sensitive nerve endings called *nociceptors* react to headache *triggers* (such as stress, certain foods or odors, or use of medicines) and send messages through the trigeminal nerve to the thalamus, the brain's "relay station" for pain sensation from all over the body. The thalamus controls the body's sensitivity to light and noise and sends messages to parts of the brain that manage awareness of pain and emotional response to it. Other parts of the brain may also be part of the process, causing nausea, vomiting, diarrhea, trouble concentrating, and other neurological symptoms.

When to See a Doctor

Not all headaches require a physician's attention. But headaches can signal a more serious disorder that requires prompt medical care. Immediately call or see a physician if you or someone you're with experience any of these symptoms:

- Sudden, severe headache that may be accompanied by a stiff neck.
- Severe headache accompanied by fever, nausea, or vomiting that is not related to another illness.
- “First” or “worst” headache, often accompanied by confusion, weakness, double vision, or loss of consciousness.



A sudden, severe headache accompanied by a stiff neck, or by fever, nausea, or vomiting requires prompt medical care.

- Headache that worsens over days or weeks or has changed in pattern or behavior.
- Recurring headache in children.
- Headache following a head injury.
- Headache and a loss of sensation or weakness in any part of the body, which could be a sign of a stroke.
- Headache associated with convulsions.
- Headache associated with shortness of breath.
- Two or more headaches a week.
- Persistent headache in someone who has been previously headache-free, particularly in someone over age 50.
- New headaches in someone with a history of cancer or HIV/AIDS.

Diagnosing Your Headache

How and under what circumstances a person experiences a headache can be key to diagnosing its cause. Keeping a headache journal can help a physician better diagnose your type of headache and determine the best treatment. After each headache, note the time of day when it occurred; its intensity and duration; any sensitivity to light, odors, or sound; activity immediately prior to the headache; use of prescription and nonprescription medicines; amount of sleep the previous night; any stressful or emotional conditions; any influence from weather or daily activity; foods and fluids consumed in the past 24 hours; and any known health conditions at that time. Women should record the days of their menstrual cycles. Include notes about other family members who have a history of headache or other disorder. A pattern may emerge that can be helpful to reducing or preventing headaches.

Once your doctor has reviewed your medical and headache history and conducted a physical and neurological exam, lab screening and diagnostic tests may be ordered to either rule out or identify conditions that might be the cause of your headaches. Blood tests and urinalysis can help diagnose brain or spinal cord infections, blood vessel damage, and toxins that affect the nervous system. Testing a sample of the fluid that surrounds the brain and spinal cord can detect infections, bleeding in the brain (called a brain hemorrhage), and measure any buildup of pressure within the skull. Diagnostic imaging, such as with computed tomography (CT) and magnetic resonance imaging (MRI), can detect irregularities in blood vessels and bones,

certain brain tumors and cysts, brain damage from head injury, brain hemorrhage, inflammation, infection, and other disorders. Neuroimaging also gives doctors a way to see what's happening in the brain during headache attacks. An electroencephalogram (EEG) measures brain wave activity and can help diagnose brain tumors, seizures, head injury, and inflammation that may lead to headaches.

Headache Types and Their Treatment

The International Classification of Headache Disorders, published by the International Headache Society, is used to classify more than 150 types of primary and secondary headache disorders.

Primary headache disorders are divided into four main groups: migraine, tension-type headache, trigeminal autonomic cephalgias (a group of short-lasting but severe headaches), and a miscellaneous group.

Migraine

If you suffer from migraine headaches, you're not alone. About 12 percent of the U.S. population experience migraines, one form of vascular headaches. Vascular headaches are characterized by throbbing and pulsating pain caused by the activation of nerve fibers that reside within the wall of brain blood vessels traveling within the meninges. Blood vessels narrow, temporarily, which decreases the flow of blood and oxygen to the brain. This causes other blood vessels to open wider and increase blood flow.

Migraines involve recurrent attacks of moderate to severe pain that is throbbing or pulsing and often strikes one side of the head. Untreated attacks last from 4 to 72 hours. Other common symptoms are increased sensitivity to light, noise, and odors; and nausea and vomiting. Routine physical activity, movement, or even coughing or sneezing can worsen the headache pain.



Caffeine (or caffeine withdrawal) is one of many triggers for migraine headaches.

Migraines occur most frequently in the morning, especially upon waking. Some people have migraines at predictable times, such as before menstruation or on weekends following a stressful week of work. Many people feel exhausted or weak following a migraine but are usually symptom-free between attacks.

A number of different factors can increase your risk of having a migraine. These factors, which trigger the headache process, vary from person to person and include sudden changes in weather or environment, too much or not enough sleep, strong odors or fumes, emotion, stress, overexertion, loud or sudden noises, motion sickness, low blood sugar, skipped meals, tobacco, depression, anxiety, head trauma, hang-over, some medications, hormonal changes, and bright or flashing lights. Medication overuse or missed doses may also cause headaches. In some 50 percent of migraine sufferers, foods or ingredients can trigger headaches. These include aspartame, caffeine (or caffeine withdrawal), wine and other types of alcohol, chocolate, aged cheeses, monosodium glutamate, some fruits and nuts, fermented or pickled goods, yeast, and cured or processed meats. Keeping a diet journal will help identify food triggers.

Who Gets Migraines? Migraines occur in both children and adults, but affect adult women three times more often than men. There is evidence that migraines are genetic, with most migraine sufferers having a family history of the disorder. They also frequently occur in people who have other medical conditions. Depression, anxiety, bipolar disorder, sleep disorders, and epilepsy are more common in individuals with migraine than in the general population. Migraine sufferers—in particular those individuals who have pre-migraine symptoms referred to as *aura*—have a slightly increased risk of having a stroke.

Migraine in women often relates to changes in hormones. The headaches may begin at the start of the first menstrual cycle or during pregnancy. Most women see improvement after menopause, although surgical removal of the ovaries usually worsens migraines. Women with migraine who take oral contraceptives may experience changes in the frequency and severity of attacks, while women who do not suffer from headaches may develop migraines as a side effect of oral contraceptives.

Phases of Migraine. Migraine is divided into four phases, all of which may be present during the attack:

- **Premonitory** symptoms occur up to 24 hours prior to developing a migraine. These include food cravings, unexplained mood changes (depression or euphoria), uncontrollable yawning, fluid retention, or increased urination.
- **Aura.** Some people will see flashing or bright lights or what looks like heat waves immediately prior to or during the migraine, while others may experience muscle weakness or the sensation of being touched or grabbed.

- **Headache.** A migraine usually starts gradually and builds in intensity. It is possible to have migraine without head pain.
- **Postdrome** (following the headache). Individuals are often exhausted or confused following a migraine. The postdrome period may last up to a day before people feel healthy.

Types of Migraine. The two major types of migraine are:

- **Migraine with aura**, previously called classic migraine, includes visual disturbances and other neurological symptoms that appear about 10 to 60 minutes before the actual headache and usually last no more than an hour. Individuals may temporarily lose part or all of their vision. The aura may occur without headache pain, which can strike at

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Nausea, loss of appetite, and increased sensitivity to light, sound, or noise may precede the headache.

Nausea, appetite loss, and sensitivity to light or sound may precede migraine headache.

- **Migraine without aura**, or common migraine, is the more frequent form of migraine. Symptoms include headache pain that occurs without warning and is usually felt on one side of the head, along with nausea, confusion, blurred vision, mood changes, fatigue, and increased sensitivity to light, sound, or noise.

Other types of migraine include:

- **Abdominal migraine** mostly affects young children and involves moderate to severe pain in the middle of the abdomen lasting 1 to 72 hours, with little or no headache. Additional symptoms include nausea, vomiting, and loss of appetite. Many children who develop abdominal migraine will have migraine headaches later in life.
- **Basilar-type migraine** mainly affects children and adolescents. It occurs most often in teenage girls and may be associated with their menstrual cycle. Symptoms include partial or total loss of vision or double vision, dizziness and loss of balance, poor muscle coordination, slurred speech, a ringing in the ears, and fainting. The throbbing pain may come on suddenly and is felt on both sides at the back of the head.
- **Hemiplegic migraine** is a rare but severe form of migraine that causes temporary paralysis—sometimes lasting several days—on one side of the body prior to or during a headache. Symptoms such as vertigo, a pricking or stabbing sensation, and problems seeing, speaking, or swallowing may begin prior to the headache pain and usually stop shortly thereafter. When it runs in families the disorder is called familial hemiplegic migraine (FHM). Though rare, at least three distinct genetic forms of FHM have been identified. These genetic mutations make the brain more sensitive or excitable, most likely by increasing brain levels of a chemical called glutamate.

- **Menstrually related migraine** affects women around the time of their period, although most women with menstrually related migraine also have migraines at other times of the month. Symptoms may include migraine without aura (which is much more common during menses than migraine with aura), pulsing pain on one side of the head, nausea, vomiting, and increased sensitivity to sound and light.
- **Migraine without headache** is characterized by visual problems or other aura symptoms, nausea, vomiting, and constipation, but without head pain. Headache specialists have suggested that fever, dizziness, and/or unexplained pain in a particular part of the body could also be possible types of headache-free migraine.
- **Ophthalmoplegic migraine** an uncommon form of migraine with head pain, along with a droopy eyelid, large pupil, and double vision that may last for weeks, long after the pain is gone.
- **Retinal migraine** is a condition characterized by attacks of visual loss or disturbances in one eye. These attacks, like the more common visual auras, are usually associated with migraine headaches.
- **Status migrainosus** is a rare and severe type of acute migraine in which disabling pain and nausea can last 72 hours or longer. The pain and nausea may be so intense that sufferers need to be hospitalized.

Migraine Treatment. Migraine treatment is aimed at relieving symptoms and preventing additional attacks. Quick steps to ease symptoms may include napping or resting with eyes closed in a quiet,

darkened room;
placing a cool
cloth or ice pack
on the forehead;
and drinking
lots of fluid,
particularly if
the migraine is
accompanied by
vomiting. Small
amounts of caffeine may help relieve symptoms
during a migraine’s early stages.



The primary goals of migraine treatment are to relieve symptoms and prevent additional attacks. Over-the-counter drugs can ease the pain of less severe migraine headaches.

Drug therapy for migraine is divided into acute and preventive treatment. Acute or “abortive” medications are taken as soon as symptoms occur to relieve pain and restore function. Preventive treatment involves taking medicines daily to reduce the severity of future attacks or keep them from happening. The U.S. Food and Drug Administration (FDA) has approved a variety of drugs for these treatment methods.² Headache drug use should be monitored by a physician, since some drugs may cause side effects.

Acute treatment for migraine may include any of the following drugs.

- *Triptan* drugs increase levels of the neurotransmitter *serotonin* in the brain. Serotonin causes blood vessels to constrict and lowers the pain threshold. Triptans—the preferred treatment for migraine—ease moderate to severe migraine pain and are available as tablets, nasal sprays, and injections.
- *Ergot derivative drugs* bind to serotonin receptors on nerve cells and decrease the

² For information about drugs to treat migraine, visit the Food and Drug Administration web site at www.fda.gov or call 800-INFO-FDA.

transmission of pain messages along nerve fibers. They are most effective during the early stages of migraine and are available as nasal sprays and injections.

- Non-prescription analgesics or over-the-counter drugs such as ibuprofen, aspirin, or acetaminophen can ease the pain of less severe migraine headache.
- Combination analgesics involve a mix of drugs such as acetaminophen plus caffeine and/or a narcotic for migraine that may be resistant to simple analgesics.
- Nonsteroidal anti-inflammatory drugs can reduce inflammation and alleviate pain.
- Nausea relief drugs can ease queasiness brought on by various types of headache.
- Narcotics are prescribed briefly to relieve pain. These drugs should not be used to treat chronic headaches.

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Taking headache relief drugs more than three times a week may lead to **medication overuse headache** (previously called rebound headache), in which the initial headache is relieved temporarily but reappears as the drug wears off. Taking more of the drug to treat the new headache leads to progressively shorter periods of pain relief and results in a pattern of recurrent chronic headache. Headache pain ranges from moderate to severe and may occur with nausea or irritability. It may take weeks for these headaches to end once the drug is stopped.

Everyone with migraine needs effective treatment at the time of the headaches. Some people with frequent and severe migraine need preventive

medications. In general, prevention should be considered if migraines occur one or more times weekly, or if migraines are less frequent but disabling. Preventive medicines are also recommended for individuals who take symptomatic headache treatment more than 3 times a week. Physicians will also recommend that a migraine sufferer take one or more preventive medications 2 to 3 months to assess drug effectiveness, unless intolerable side effects occur.

Several preventive medicines for migraine were initially marketed for conditions other than migraine.

- Anticonvulsants may be helpful for people with other types of headaches in addition to migraine. Although they were originally developed for treating epilepsy, these drugs increase levels of certain neurotransmitters and dampen pain impulses.
- Beta-blockers are drugs for treating high blood pressure that are often effective for migraine.
- Calcium channel blockers are medications that are also used to treat high blood pressure and help to stabilize blood vessel walls. These drugs appear to work by preventing the blood vessels from either narrowing or widening, which affects blood flow to the brain.
- Antidepressants are drugs that work on different chemicals in the brain; their effectiveness in treating migraine is not directly related to their effect on mood. Antidepressants may be helpful for individuals with other types of headaches because they increase the production of serotonin and may also affect levels of other chemicals, such as norepinephrine and dopamine. The types of antidepressants

used for migraine treatment include selective serotonin reuptake inhibitors, serotonin and norepinephrine reuptake inhibitors, and tricyclic antidepressants (which are also used to treat tension-type headaches).

Natural treatments for migraine include riboflavin (vitamin B2), magnesium, coenzyme Q10, and butterbur.

Non-drug therapy for migraine includes *biofeedback* and relaxation training, both of which help individuals cope with or control the development of pain and the body's response to stress.

Lifestyle changes that reduce or prevent migraine attacks in some individuals include exercising, avoiding food and beverages that trigger headaches, eating regularly scheduled meals with adequate hydration, stopping certain medications, and establishing a consistent sleep schedule. Obesity increases the risk of developing chronic daily headache, so a weight loss program is recommended for obese individuals.

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Tension-type

Tension-type headache, previously called muscle contraction headache, is the most common type of headache. Its name indicates the role of stress and mental or emotional conflict in triggering the pain and contracting muscles in the neck, face, scalp, and jaw. Tension-type headaches may also be caused by jaw clenching, intense work, missed meals,



Tension-type headaches—the most common type of headache—may feel as if a belt or “vice” is being tightened around the head.

depression, anxiety, or too little sleep. Sleep apnea may also cause tension-type headaches, especially in the morning. The pain is usually mild to moderate and feels as if constant pressure is being applied to the front of the face or to the head or neck. It also may feel as if a belt is being tightened around the head. Most often the pain is felt on both sides of the head. People who suffer tension-type headaches may also feel overly sensitive to light and sound but there is no pre-headache aura as with migraine. Typically, tension-type headaches usually disappear once the period of stress or related cause has ended.

Tension-type headaches affect women slightly more often than men. The headaches usually begin in adolescence and reach peak activity in the 30s. They have not been linked to hormones and do not have a strong hereditary connection.

There are two forms of tension-type headache: *Episodic* tension-type headaches occur between 10 and 15 days per month, with each attack lasting from 30 minutes to several days. Although the pain is not disabling, the severity of pain typically increases with the frequency of attacks. *Chronic* tension-type attacks usually occur more than 15 days per month over a 3-month period. The pain, which can be constant over a period of days or months, strikes both sides of the head and is more severe and disabling than episodic headache pain. Chronic tension headaches can cause sore scalps—even combing your hair can be painful. Most individuals will have had some form of episodic tension-type headache prior to onset of chronic tension-type headache.

Depression and anxiety can cause tension-type headaches. Headaches may appear in the early morning or evening, when conflicts in the office or at home are anticipated. Other causes include physical postures that strain head and neck muscles (such as holding your chin down while reading or holding a phone between your shoulder and ear), degenerative arthritis of the neck, and temporomandibular joint dysfunction (a disorder of the joints between the temporal bone located above the ear and the mandible, or lower jaw bone).

The first step in caring for a tension-type headache involves treating any specific disorder or disease that may be causing it. For example, arthritis of the neck is treated with anti-inflammatory medication and temporomandibular joint dysfunction may be helped by corrective devices for the mouth and jaw. A sleep study may be needed to detect sleep apnea and should be considered when there is a history of snoring, daytime sleepiness, or obesity.

A physician may suggest using analgesics, nonsteroidal anti-inflammatory drugs, or antidepressants to treat a tension-type headache that is not associated with a disease. Triptan drugs, barbiturates (drugs that have a relaxing or sedative effect), and ergot derivatives may provide relief to people who suffer from both migraine and tension-type headache.

Alternative therapies for chronic tension-type headaches include biofeedback, relaxation training, meditation, and cognitive-behavioral therapy to reduce stress. A hot shower or moist heat applied to the back of the neck may ease symptoms of infrequent tension headaches. Physical therapy, massage, and gentle exercise of the neck may also be helpful.

Trigeminal Autonomic Cephalgias

Some primary headaches are characterized by severe pain in or around the eye on one side of the face and *autonomic* (or involuntary) features on the same side, such as red and teary eye, drooping eyelid, and runny nose. These disorders, called trigeminal autonomic cephalgias (*cephalgia* meaning head pain), differ in attack duration and frequency, and have episodic and chronic forms. Episodic attacks occur on a daily or near-daily basis for weeks or months with pain-free remissions. Chronic attacks occur on a daily or near-daily basis for a year or more with only brief remissions.

Cluster headache—the most severe form of primary headache—involves sudden, extremely painful headaches that occur in “clusters,” usually at the same time of the day and night for several weeks. They strike one side of the head, often behind or around one eye, and may be preceded by a migraine-like aura and nausea. The pain usually peaks 5 to 10 minutes after onset and continues at that intensity for up to 3 hours.

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Cluster headaches involve sudden, extremely painful headaches that occur at the same time of the day or night. They can be provoked by alcohol, especially red wine, and smoking.

The nose and the eye on the affected side of the face may get red, swollen, and teary. Some people will experience restlessness and agitation, changes in heart rate and blood pressure, and sensitivity to light, sound, or smell. Cluster headaches often wake people from sleep.

Cluster headaches generally begin between the ages of 20 and 50 but may start at any age, occur more often in men than in women, and are more common in smokers than in nonsmokers. The attacks are usually less frequent and shorter than migraines. It's common to have 1 to 3 cluster headaches a day with 2 cluster periods a year, separated by months of freedom from symptoms. The cluster periods often appear seasonally, usually in the spring and fall, and may be mistaken for allergies. A small group of people develop a chronic form of the disorder, which is characterized by bouts of headaches that can go on for years with only brief periods (1 month or less) of remission. Cluster headaches occur more often at night than during the day, suggesting they could be caused by irregularities in the body's sleep-wake cycle. Alcohol (especially red wine) and smoking can provoke attacks. Studies show a connection between cluster headache and prior head trauma. An increased familial risk of these headaches suggests that there may be a genetic cause.

Treatment options include oxygen therapy—in which pure oxygen is breathed through a mask to reduce blood flow to the brain—and triptan drugs. Certain antipsychotic drugs, calcium-channel blockers, and anticonvulsants can reduce pain severity and frequency of attacks. In extreme cases, electrical stimulation of the occipital nerve to prevent nerve signaling or surgical procedures that destroy or cut certain facial nerves may provide relief.

Paroxysmal hemicrania is a rare form of primary headache that usually begins in adulthood. Pain and related symptoms may be similar to those felt in cluster headaches, but with shorter duration. Attacks typically occur 5 to 40 times per day, with each attack lasting 2 to 45 minutes. Severe throbbing, claw-like, or piercing pain is felt on one side of the face—in, around, or behind the eye and occasionally reaching to the back of the neck. Other symptoms may include red and watery eyes, a drooping or swollen eyelid on the affected side of the face, and nasal congestion. Individuals may also feel dull pain, soreness, or tenderness between attacks or increased sensitivity to light on the affected side of the face. Paroxysmal hemicrania has two forms: chronic, in which individuals experience attacks on a daily basis for a year or more, and episodic, in which the headaches may stop for months or years before recurring. Certain movements of the head or neck, external pressure to the neck, and alcohol use may trigger these headaches. Attacks occur more often in women than in men and have no familial pattern.

The nonsteroidal anti-inflammatory drug indomethacin can quickly halt the pain and related symptoms of paroxysmal hemicrania, but symptoms recur once the drug treatment is stopped. Non-prescription analgesics and calcium-channel blockers can ease discomfort, particularly if taken when symptoms first appear.

SUNCT (Short-lasting, Unilateral, Neuralgiform headache attacks with Conjunctival injection and Tearing) is a very rare type of headache with bursts of moderate to severe burning, piercing, or throbbing pain that is usually felt in the forehead,

eye, or temple on one side of the head. The pain usually peaks within seconds of onset and may follow a pattern of increasing and decreasing intensity. Attacks typically occur during the day and last

from 5 seconds to 4 minutes per episode. Individuals generally have five to six attacks per hour and are pain-free between

attacks. This primary headache is slightly more common in men than in women, with onset usually after age 50. SUNCT may be episodic, occurring once or twice annually with headaches that remit and recur, or chronic, lasting more than 1 year.

Symptoms include reddish or bloodshot eyes (conjunctival injection), watery eyes, stuffy or runny nose, sweaty forehead, puffy eyelids, increased pressure within the eye on the affected side of the head, and increased blood pressure.

SUNCT is very difficult to treat. Anticonvulsants may relieve some of the symptoms, while anesthetics and corticosteroid drugs can treat some of the severe pain felt during these headaches. Surgery and glycerol injections to block nerve signaling along the trigeminal nerve have poor outcomes and provide only temporary relief in severe cases. Doctors are beginning to use deep brain stimulation (involving a surgically implanted battery-powered electrode that emits pulses of energy to surrounding brain tissue) to reduce the frequency of attacks in severely affected individuals.

SUNCT headaches cause bursts of burning, piercing, or throbbing pain usually in the forehead, eye, or temple on one side of the head.

Miscellaneous Primary Headaches

Other headaches that are not caused by other disorders include:

Chronic daily headache refers to a group of headache disorders that occur at least 15 days a month during a 3-month period. In addition to chronic tension-type headache, chronic migraine, and medication overuse headache, these headaches include hemicrania continua and new daily persistent headache. Individuals feel constant, mostly moderate pain throughout the day on the sides or top of the head. They may also experience other types of headache. Adolescents and adults may experience chronic daily headaches. In children, stress from school and family activities may contribute to these headaches.

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- **Hemicrania continua** is marked by continuous, fluctuating pain that always occurs on the same side of the face and head. The headache may last from minutes to days and is associated with symptoms including tearing, red and irritated eyes, sweating, stuffy or runny nose, and swollen and drooping eyelids. The pain may get worse as the headache progresses. Migraine-like symptoms include nausea, vomiting, and sensitivity to light and sound. Physical exertion and alcohol use may increase headache severity. The disorder is more common in women than in men and its cause is unknown. Hemicrania continua has two forms: chronic, with daily headaches, and remitting or episodic, in which headaches may occur over a period of 6 months and are followed by a pain-free period of weeks to months before recurring. Most individuals have attacks of

increased pain 3 to 5 times per 24-hour cycle. The nonsteroidal anti-inflammatory drug indomethacin usually provides rapid relief from symptoms. Corticosteroids may also provide temporary relief from some symptoms.

- **New Daily Persistent Headache (NDPH)**, previously called chronic benign daily headache, is known for its constant daily pain that ranges from mild to severe. Individuals can often recount the exact date and time that the headache began. Daily headaches can occur for more than 3 months (and sometimes years) without lessening or ending. Symptoms include an abnormal sensitivity to light or sound, nausea, lightheadedness, and a pressing, throbbing, or tightening pain felt on both sides of the head. NDPH occurs more often in women than in men. Most sufferers do not have a prior history of headache. NDPH may occur spontaneously or following infection, medication use, trauma, high spinal fluid pressure, or other condition. The disorder has two forms: one that usually ends on its own within several months and does not require treatment, and a longer-lasting form that is difficult to treat. Muscle relaxants, antidepressants, and anticonvulsants may provide some relief.

Primary stabbing headache, also known as “ice pick” or “jabs and jolts” headache, is characterized by intense piercing pain that strikes without warning and generally lasts 1 to 10 seconds. The stabbing pain usually occurs around the eye but may be felt in multiple sites along the trigeminal nerve. Onset typically occurs between 45 and 50 years of age. Some individuals may have only

one headache per year while others may have multiple headaches daily. Most attacks are spontaneous but headaches may be triggered by sudden movement, bright lights, or emotional stress.

Primary stabbing headache occurs most often in people who have migraine, hemicrania continua, tension-type, or cluster headaches. The disorder is hard to treat, because each attack is extremely short. Indomethacin and other headache preventive medications can relieve pain in people who have multiple episodes of primary stabbing headache.

Primary exertional headache may be brought on by fits of coughing or sneezing or intense physical activity such as running, basketball, lifting weights, or sexual activity. The headache begins at the onset of activity. Pain rarely lasts more than several minutes but can last up to 2 days. Symptoms may include nausea and vomiting. This type of headache is typically seen in individuals who have a family history of migraine. Warm-up exercises prior to the physical activity can help prevent the headache and indomethacin can relieve the headache pain.

Hypnic headache, previously called “alarm-clock” headache, awakens people mostly at night. Onset is usually after age 50. Hypnic headache may occur 15 or more times per month, with no known trigger. Bouts of mild to moderate throbbing pain usually last from 15 minutes to 3 hours after waking and are most often felt on both sides of the head. Other symptoms include nausea or increased



Hypnic or “alarm clock” headaches usually awaken people at night with bouts of mild to moderate throbbing pain lasting from 15 minutes to 3 hours.

sensitivity to sound or light. Hypnic headache may be a disorder of rapid eye movement (REM) sleep as the attacks occur most often during dreaming. Both men and women are affected by this disorder, which is usually treated with caffeine, indomethacin, or lithium.

If you've ever eaten or inhaled a cold substance very fast, you may have had what's called an **ice cream headache** (sometimes called "brain freeze"). This headache happens when cold materials such as cold drinks or ice cream hit the warm roof of your mouth. Local blood vessels constrict to reduce the loss of body heat and then relax and allow the blood flow to increase. The resulting burst of pain lasts for about 5 minutes. Ice cream headache is more common in individuals who have migraine. The pain stops once the body adapts to the temperature change.

Secondary headache disorders are caused by an underlying illness or condition that affects the brain. Secondary headaches are usually diagnosed based on other symptoms that occur concurrently and the characteristics of the headaches. Some of the more serious causes of secondary headache include:

Brain tumor. A tumor that is growing in the brain can press against nerve tissue and pain-sensitive blood vessel walls, disrupting communication between the brain and the nerves or restricting the supply of blood to the brain. Headaches may develop, worsen, become more frequent, or come and go, often at irregular periods. Headache pain may worsen when coughing, changing posture, or straining, and may be severe upon waking. Treatment options include surgery, radiation therapy, and chemotherapy. However, the vast majority of individuals with headache do not have brain tumors.

Disorders of blood vessels in the brain, including stroke. Several disorders associated with blood vessel formation and activity can cause headache. Most notable among these conditions is stroke. Headache itself can cause stroke or accompany a series of blood vessel disorders that can cause a stroke.

Secondary headaches are caused by underlying illnesses or conditions that affect the brain.

There are two forms of stroke. A hemorrhagic stroke occurs when an artery in the brain bursts, spilling blood into the surrounding

tissue. An ischemic stroke occurs when an artery supplying the brain with blood becomes blocked, suddenly decreasing or stopping blood flow and causing brain cells to die.

Hemorrhagic Stroke

A hemorrhagic stroke is usually associated with disturbed brain function and an extremely painful headache that develops suddenly and may worsen with physical activity, coughing, or straining. Headache conditions associated with hemorrhagic stroke include:

- A subarachnoid hemorrhage is the rupture of a blood vessel located within the subarachnoid space—a fluid-filled space between layers of connective tissue (meninges) that surround the brain. The first sign of a subarachnoid hemorrhage is typically a severe headache with a split-second onset and no known cause. Neurologists call this a thunderclap headache. Pain may also be felt in the neck and lower back. This sudden flood of blood can contaminate the cerebrospinal fluid that flows within

the spaces of the brain and cause extensive damage throughout the brain.

- Intracerebral hemorrhage is usually associated with severe headache. Several conditions can render blood vessels in the brain prone to rupture and hemorrhaging. Chronic hypertension can weaken the blood vessel wall. Poor blood clotting ability due to blood disorders or blood-thinning medications like warfarin further increase the risk of bleeding. And some venous strokes (caused by clots in the brain's veins) often cause bleeding into the brain. At risk are mothers in the post-partum period and persons with dehydration, cancer, or infections.
- An aneurysm is the abnormal ballooning of an artery that causes the artery wall to weaken. A ruptured cerebral aneurysm can cause hemorrhagic stroke and a sudden, incredibly painful headache that is generally different in severity and intensity from other headaches individuals may have experienced. Individuals usually describe the thunderclap-like headache as "the worst headache of my life." There may be loss of consciousness and other neurological features. "Sentinel" or sudden warning headaches sometimes occur from an aneurysm that leaks prior to rupture. Cerebral aneurysms that have leaked or ruptured are life-threatening and require emergency medical attention. Not all aneurysms burst, and people with very small aneurysms may be monitored to detect any growth or onset of symptoms. Treatment options include blocking the flow of blood to the aneurysm surgically (intra-arterial) and catheter techniques to fill the aneurysm with coils or balloons.

- *Arteriovenous malformation (AVM)*, an abnormal tangle of arteries and veins in the brain, causes headaches that vary in frequency, duration, and intensity as vascular malformations press on and displace normal tissue or leak blood into surrounding tissue. A headache consistently affecting one side of the head may be closely linked to the site of an AVM (although most one-sided headaches are caused by primary headache disorders). Symptoms may include seizures and hearing pulsating noises. Treatment options include decreasing blood flow to and from the malformation by injecting particles or glue, or through focused radiotherapy or surgery.

Ischemic Stroke

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Headache that accompanies ischemic stroke can be caused by several problems with the brain's vascular system. Headache is prominent in individuals with clots in the brain's veins. Head pain occurs on the side of the brain in which the clot blocks blood flow and is often felt in the eyes or on the side of the head. Conditions of ischemic stroke that can cause headache include:

- *Arterial dissection* is a tear within an artery that supplies the brain with blood flow. The most common dissection occurs in the carotid artery in the neck, with head pain on the same side of the body where the tear occurs. Vertebral artery dissection causes pain in the rear upper part of the neck. Cervical artery dissection can lead to stroke or *transient ischemic attacks* (strokes that last only a few minutes but signal a subsequent, more severe stroke). They are usually caused by neck

strain, i.e., trauma, chiropractic manipulation, sports injuries, or even pronounced bending of the head backwards over a sink for hair washing (“beauty parlor stroke”). Immediate medical attention can be lifesaving.

- **Vascular inflammation can cause the buildup of plaque, which can lead to ischemic stroke.** Cerebral vasculitis, an inflammation of the brain’s blood vessel system, may cause headache, stroke, and/or progressive cognitive decline. Severe headache attributed to a chronic inflammatory disease of blood vessels on the outside of the head, called giant cell arteritis (previously known as temporal arteritis), usually affects people older than age 60. It also causes muscle pain and tenderness in the temple area. Individuals also may experience temporary, followed by permanent, loss of vision on one or both eyes, pain with chewing, a tender scalp, muscle aches, depression, and fatigue. Corticosteroids are typically used to treat vascular inflammation and can prevent blindness.

Exposure to a substance or its withdrawal.

Headaches may result from toxic states such as drinking alcohol, following carbon monoxide poisoning, or from exposure to toxic chemicals and metals, cleaning products or solvents, and pesticides. In the most severe cases, rising toxin levels can cause a pulsing, throbbing headache that, if left untreated, can lead to systemic poisoning, organ failure, and permanent neurological damage. These headaches are usually treated by identifying and removing the cause of the toxic buildup. The withdrawal from certain medicines or caffeine after frequent or excessive use can also cause headaches.

Head injury. Headaches are often a symptom of a concussion or other head injury. The headache may develop either immediately or months after a blow to the head, with pain felt at the injury site or throughout the head. Emotional disturbances may worsen headache pain. In most cases, the cause of post-traumatic headache is unknown. Sometimes

Headaches associated with head trauma may develop immediately or months after a blow to the head.

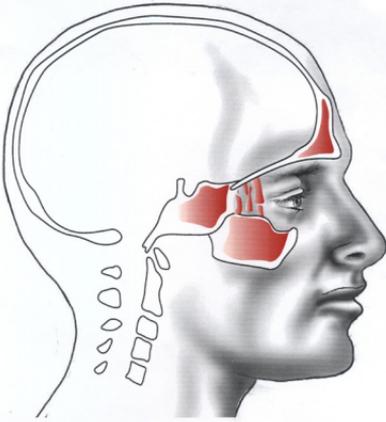
the cause is ruptured blood vessels, which result in an accumulation of blood called a hematoma. This mass of blood can displace brain tissue and cause headaches

as well as weakness, confusion, memory loss, and seizures. Hematomas can be drained surgically to produce rapid relief of symptoms. Bleeding between the dura (the outermost layer of the protective covering of the brain) and the skull, called epidural hematoma, usually occurs minutes to hours after a skull fracture and is especially dangerous. Bleeding between the brain and the dura, called subdural hematoma, is frequently associated with a dull, persistent ache on one side of the head. Nausea, vomiting, and mild disturbance of brain function also occur. Subdural hematoma may occur after head trauma but also occurs spontaneously in elderly persons or in individuals taking anticoagulant medications.

Increased intracranial pressure. A growing tumor, infection, or hydrocephalus (an extensive buildup of cerebrospinal fluid in the brain) can raise pressure in the brain and compress nerves and blood vessels, causing headaches. Hydrocephalus is most often treated with the surgical placement of a shunt system that diverts the fluid to a site elsewhere in the body, where it can be absorbed as part of the circulatory process. Headache attributed to idiopathic

intracranial hypertension, previously known as pseudotumor cerebri (meaning “false brain tumor”), is associated with severe headache. It can be caused by clotting in the major cerebral veins or certain medications (some antibiotics, withdrawal of corticosteroids, human growth hormone replacement, and vitamin A and related compounds). It is most commonly seen in young, overweight females. Diagnosis usually requires a spinal fluid examination to document the high pressure and the rapid resolution of headache after the spinal fluid is removed. Although called benign, the condition may lead to visual loss if left untreated. Weight loss, ending the use of the drug suspected of causing the problem, and diuretic treatment can help relieve the pressure.

Inflammation from meningitis, encephalitis, and other infections. Inflammation from infections can harm or destroy nerve cells and cause dull to severe headache pain, brain damage, or stroke, among other conditions. Inflammation of the brain and spinal cord (meningitis and encephalitis) requires urgent medical attention. Diagnosis and identification of the infection usually requires examination and culture of a sample of the cerebrospinal fluid. Treatment options include antibiotics, antiviral or antifungal drugs, corticosteroids, pain medications and sedatives, and anticonvulsants. Headaches may also occur with a fever or a flu-like infection. A headache may accompany a bacterial infection of the upper respiratory tract that spreads to and inflames the lining of the sinus cavities. When one or more of the cavities fills with fluid from the inflammation, the result is constant but dull facial pain and tenderness that worsens with straining or head movements. Treatment includes antibiotics, analgesics, and decongestants. Sinus infections do not generally cause chronic headaches.



“Sinus” headaches occur when one or more of the sinus cavities fills with fluid caused by inflammation resulting in constant dull facial pain and tenderness.

Seizures. Migraine-like headache pain may occur during or after a seizure. Moderate to severe headache pain may last for several hours and worsen with sudden movements of the head or when sneezing, coughing, or bending. Other symptoms may include nausea, vomiting, fatigue, increased sensitivity to light or sound, and vision problems.

Spinal fluid leak. About one-fourth of people who undergo a lumbar puncture (which involves a small sampling of the spinal fluid being removed for testing) develop a headache due to a leak of cerebrospinal fluid following the procedure. Since the headache occurs only when the individual stands up, the “cure” is to lie down until the headache runs its course—anywhere from a few hours to several days. Severe post-dural headaches may be treated by injecting a small amount of the individual’s blood into the lower back to stop the leak (called an epidural blood patch). Occasionally spinal fluid leaks spontaneously, causing this “low pressure headache.”

Structural abnormalities of the head, neck and spine. Headache pain and loss of function may be triggered by structural abnormalities in the head or spine, restricted blood flow through the neck, irritation to nerves anywhere along the path from the spinal cord to the brain, or stressful or awkward

positions of the head and neck. Surgery is the only treatment available to correct the condition or halt the progression of damage to the central nervous system. Medications may ease the pain. Cervicogenic headaches are caused by structural irregularities in either the head or neck. In a chiari malformation, the back of the skull is too small for the brain. This forces a part of the brain to block the normal flow of spinal fluid and press on the brain stem. Chiari malformations are present at birth but may not cause symptoms until later in life. Common symptoms include dizziness, muscle weakness, vision problems, and headache that worsens with coughing or straining. Syringomyelia, a fluid-filled cyst within the spinal cord, can cause pain, numbness, weakness, and headaches.

Trigeminal neuralgia. The trigeminal nerve conducts sensations to the brain from the upper, middle, and lower portions of the face, as well as inside the mouth. The presumed cause of trigeminal neuralgia is a blood vessel pressing on the nerve as it exits the brain stem, but other causes have been described. Symptoms include headache and intense shock-like or stabbing pain that comes on suddenly and is typically felt on one side of the jaw or cheek. Muscle spasms may occur on the affected side of the face. The pain may occur spontaneously or be triggered by touching the cheek, as happens when shaving, washing, or applying makeup. The pain also may occur when eating, drinking, talking, smoking, or brushing teeth, or when the face is exposed to wind. Treatment options include anti-convulsants, antidepressants, and surgery to block pain signaling to the brain.

Children and Headache

Headaches are common in children. Headaches that begin early in life can develop into migraines as the child grows older. Migraines in children or adolescents can develop into tension-type headaches at any time. In contrast to adults with migraine, young children often feel migraine pain on both sides of the head and have headaches that usually last less than 2 hours. Children may look pale and appear restless or irritable before and during an attack. Other children may become nauseous, lose their appetite, or feel pain elsewhere in the body during the headache.

Headaches in children can be caused by a number of triggers, including emotional problems such as tension between family members, stress from school activities, weather changes, irregular eating

and sleep, dehydration, and certain foods and drinks.

Of special concern among children are headaches that occur after head injury or those accompanied by rash, fever, or sleepiness.

It may be difficult to identify the type of headache because children often have problems describing where it hurts, how often the headaches occur, and how long they last. Asking a child with a headache to draw a picture of

where the pain is and how it feels can make it easier for the doctor to determine the proper treatment.



Headaches in children are common and can be caused by a number of triggers, including emotional problems, stress, weather changes, irregular sleep and eating, dehydration, and certain foods and drinks.

Migraine in particular is often misdiagnosed in children. Parents and caretakers sometimes have to be detectives to help determine that a child has a migraine. Clues to watch for include sensitivity to light and noise, which may be suspected when a child refuses to watch television or use the computer, or when the child stops playing to lie down in a dark room. Observe whether or not a child is able to eat during a headache. Very young children may seem cranky or irritable and complain of abdominal pain (abdominal migraine).

Headache treatment in children and teens usually includes rest, fluids, and over-the-counter pain relief medicines. Always consult with a physician before giving headache medicines to a child. Most tension-type headaches in children can be treated with over-the-counter medicines that are marked for children with usage guidelines based on the child's age and weight. Headaches in some children may also be treated effectively using relaxation/behavioral therapy. Children with cluster headache may be treated with oxygen therapy early in the initial phase of the attacks.

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Headache and Sleep Disorders

Headaches are often a secondary symptom of a sleep disorder. For example, tension-type headache is regularly seen in persons with insomnia or sleep-wake cycle disorders. Nearly three-fourths of individuals who suffer from narcolepsy complain of either migraine or cluster headache. Migraines and cluster headaches appear to be related to the number of and transition between rapid eye movement (REM) and other sleep periods an individual

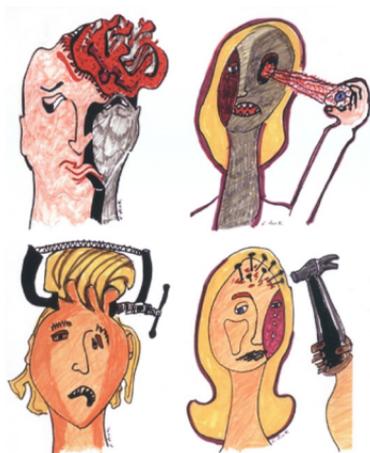
has during sleep. Hypnic headache awakens individuals mainly at night but may also interrupt daytime naps. Reduced oxygen levels in people with sleep apnea may trigger early morning headaches.

Getting the proper amount of sleep can ease headache pain. Generally, sleeping too little or too much can worsen headaches, as can overuse of sleep medicines. Daytime naps often reduce deep sleep at night and can produce headaches in some adults. Some sleep disorders and secondary headaches are treated using antidepressants. Check with a doctor before using over-the-counter medicines to ease sleep-associated headaches.

Coping with Headache

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Headache treatment is a partnership between you and your doctor, and honest communication is essential. Finding a quick fix to your headache may not be possible. It may take some time for your doctor or specialist to determine the best course of treatment. Avoid using over-the-counter medicines more than twice a week, as they may actually worsen headache pain and the frequency of attacks. Visit a local headache support group meeting (if available) to learn how others with headache cope with their pain and discomfort. Relax whenever possible to ease stress and related



Headache pain can range from mild to disabling. This drawing vividly illustrates how devastating headache pain can be. Learning to cope with headache pain and discomfort by gaining control over your headache, stress, and emotions will make you feel better and help you resume daily activities.

symptoms, get enough sleep, regularly perform aerobic exercises, and eat a regularly scheduled and healthy diet that avoids food triggers. Gaining more control over your headache, stress, and emotions will make you feel better and let you embrace daily activities as much as possible.

What Research is Being Done?

Several studies either conducted or supported by the National Institute of Neurological Disorders and Stroke (NINDS), a part of the National Institutes of Health, are revealing much about the headache process and may lead to new treatments or perhaps ways to block debilitating headache pain. Studies by other investigators are adding insight to headache etiology and treatment.

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Understanding Headache Mechanisms and Underlying Causes

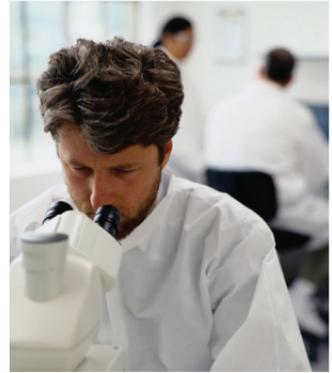
The molecular basis for migraine headaches and the aura associated with certain migraines is uncertain. One multi-faceted research study is examining how migraine with aura may affect metabolism and neurophysiological function. Investigators are also studying if particular regions of the visual cortex are unusually susceptible to the events in the brain that cause the aura. Another study component is investigating what happens at the beginning of a headache and how changes in the brain's meninges may lead to vascular and trigeminal nerve stimulation associated with the painful part of a migraine headache. Results may provide a greater understanding of migraine and assist the development of new therapies.

Mast cells, which are part of the immune system and are involved in the inflammatory allergic response, are activated in some chronic pain conditions, including headache. Researchers are examining the possibility of a relationship between the mast cells' anti-analgesic properties and their proximity to and enhanced activation of nerve fiber endings that receive and transmit pain signals (nociceptors). Mast cells may release substances that activate nociceptive nerve cells that transmit signals from the linings of the skull and its blood vessels. Findings that link mast cell activation to headache pain may identify drug targets that could lead to new analgesics for headache and other pain syndromes.

Cortical spreading depression (CSD) is a process in migraine with aura in which a wave of increased brain activity, followed by decreased activity, slowly spreads along the brain's surface. The wave of brain activity often travels across the part of the brain that processes vision and corresponds to the typical visual aura of migraine. Research has shown that migraines with aura may be associated with tiny areas of stroke-like brain damage caused by a short-term drop in oxygen levels (associated with the CSD) which prevents normal cell function and swelling in the brain's nerve cells. Animal studies have shown that CSD also irritates the trigeminal nerve, causing it to transmit pain signals and trigger inflammation in the membranes that surround the brain. CSD inhibiting drugs such as tonabersat are being tested in clinical trials for their usefulness in treating migraine and other neurological diseases. Other investigators hope to build on initial results showing that estrogen withdrawal makes it easier for CSD to occur in the brains of animals, which may explain

the contribution of estrogen fluctuation to menstrual migraines. This research may result in a better understanding of how a migraine starts in the brain and offer new methods of treatment by interrupting this process and preventing the migraine.

Cutaneous allodynia is the feeling of pain or unpleasant sensations in response to normally nonpainful stimuli, such as light touch. Researchers are investigating why it is present on the head or face in people with cluster headaches, to better understand neurological changes that occur with these headaches. Similar research is looking at why some people with migraines have more than the typical restricted allodynia that affects a particular area of the head predicted by the headache (for example, on the same side of the face as the migraine pain). Individuals with extended allodynia may experience unpleasant sensations on the side of the face opposite the headache pain or even on their feet. Previous studies have shown that sensitized nociceptors in the brain's coverings are involved in the throbbing pain of migraine and that other sensitized neurons found deeper in the brain are involved with restricted allodynia, but it is not certain which cells are responsible for extended allodynia. Future studies will explore whether nerve cells in the thalamus (which is involved in relaying signals between the brain and the body) become more sensitive as a result of the headache pain and cause extended allodynia. Findings may offer a better understanding of how the nervous system changes and becomes



Scientists are conducting studies to reveal more information about the headache process, which may lead to new treatments or ways to block debilitating headache pain.

more sensitive after repeated stimulation, resulting in chronic pain.

Social and other factors may impact headache. Researchers are examining how race and psychiatric conditions are related to headache severity, quality of life, the ability to reliably follow a treatment program, and treatment response in people with migraines, tension-type headache, substance abuse headache, or cluster headache.

Genetics of Headache

Genetics may contribute to a predisposition for migraines. Most migraine sufferers have a family member with migraine. Researchers are studying the activity of different genes to see if they make some people more likely to have migraines. One strategy is to test for a gene in several families having members with migraine and then determine if the gene is related to migraine in a broader population.

In April 2008, researchers at the University of Helsinki reported significant evidence for linkage between a gene variant on a specific site on chromosome 10q22-q23 and susceptibility to common types of migraine. The findings were from a study of 1,675 migraine sufferers or their close relatives from 210 Finnish and Australian migraine families. Another study replicated the findings in the two populations and also showed that the site was particularly linked to female migraine sufferers. Although it has been known for some time that genetic factors shared by family members make people more susceptible to migraines, this study is the first to identify convincingly a specific gene locus for common forms of migraine.

Currently under investigation are gene expression patterns (signs of changes in gene activity) in the blood of individuals during migraine attacks and among individuals with chronic daily headaches. Preliminary studies show that children with acute migraines and chronic daily headaches have specific similar gene expression profiles in their blood that are different from healthy individuals and from children with other non-related neurological diseases. Researchers are exploring differences in gene expression profiles among individuals who respond to different types of headache drugs. Study results may indicate a molecular genomic approach using blood samples to detect genes that may be activated during headaches and identify which drugs are best used for each person with migraines.

Scientists are exploring the role of the calcitonin gene-related peptide (CGRP) in migraines. Levels of the CGRP molecule, which is involved in sending signals between neurons, increase during migraine attacks and revert to normal when the pain resolves. Researchers plan to use CGRP as a model and then to use functional magnetic resonance imaging to estimate the pain response in the central nervous system. Evidence from individuals with familial hemiplegic migraine (FHM) with known mutations indicates that migraine pathways in FHM may be different from normal migraine. Investigators are also measuring levels of CGRP during the premonitory, mild, moderate, and severe phases of a single migraine compared to the baseline level when individuals are pain-free. The fluctuations of CGRP during the migraine process will help to define its role in migraine pain and may offer new opportunities for acute treatment.

Clinical Studies in Headache Management

A major focus of headache research is the development of new drugs and other treatment options. Several drug studies seek to identify new drugs to treat various headache disorders and to find safer, more effective doses for medications already being used. Other research is aimed at identifying receptors or drug targets to stop the process of migraine aura in the brain.

Results of three randomized, placebo-controlled clinical trials show the drug topiramate is effective, safe, and generally well-tolerated for treating chronic migraine. Experts agree that treatment with combinations of preventive agents offers maximum relief for the majority of individuals with chronic migraine. An NINDS-funded clinical trial is examining the effectiveness and safety of the drug propranolol combined with topiramate in reducing the frequency

of chronic migraine in 250 participants who will be randomly selected to receive treatment with both drugs or topiramate and placebo.

Sleep plays an important role in migraine. Migraine in older adults is sometimes triggered by sleep changes; regulating their sleep may lessen the frequency of migraine. Younger migraine sufferers often report migraine relief after sleep. Researchers are studying the use of the drug ramelteon, which is approved by the U.S. Food and Drug Administration for insomnia, in reducing the number of migraines over a 12-week period.



Migraine in older adults is sometimes triggered by sleep changes. Researchers are studying the role of one drug in reducing the number of migraines.

Headache is the most common symptom after a closed head injury, and it can last for more than 2 months in 60 percent of affected individuals. Unfortunately, individuals with chronic post-traumatic headaches also have cognitive and behavioral problems, and many drugs currently used to treat the headaches also have a negative influence on cognition. Scientists are testing different drugs, such as naratriptan (which acts like a neurotransmitter) and galantamine (used to treat Alzheimer's disease), to treat both the headache and cognitive disturbances in individuals with chronic post-traumatic headaches.

Non-pharmaceutical Approaches to Treatment and Prevention

Historically, very little research has been done on children with headaches. A variety of headache education and drug and/or behavioral management techniques are aimed at improving headache treatment and prevention in children and adolescents. Scientists are testing the effectiveness of combined pain coping skills (including age appropriate bio-feedback, muscle relaxation techniques, imagery, activity pacing, and the use of calming techniques) and the drug amitriptyline in reducing headache frequency, intensity, and depressive symptoms in youth ages 10 to 17 years. Additional studies include the use of alternative approaches such as yoga to decrease headache in adolescents, a modified diet to treat chronic daily headache in teenagers, and programs designed to teach very young children how to understand and self-manage their headaches.

Craniosacral therapy (CST) involves gentle massaging of the neck, head, and spine to release constraints in tissue in the head and around the

spine. Limited preliminary data shows significant, sustained benefit of CST in a small group of individuals with migraine. Future research will gather data on the usefulness of CST in preventing migraines and examine the feasibility of a larger, randomized trial.

Electrical stimulation of the occipital nerve has effectively eased the symptoms of painful chronic headache conditions such as cluster headache as well as hard to treat migraine in small clinical studies. A tiny battery-powered rechargeable electrode, surgically implanted near the occipital nerve, sends continuous energy pulses to the nerve to ease pain. The use of this non-drug treatment in reducing migraine frequency, intensity, and effect on quality of life is being tested in larger clinical trials.

Where Can I Find More Information?

The National Institute of Neurological Disorders and Stroke is the Federal government's leading supporter of biomedical research on brain and nervous system disorders, including headache. The NINDS conducts research in its own laboratories at the National Institutes of Health in Bethesda, Maryland, and supports research at institutions nationwide. For the latest information about headache and other neurological disorders, contact the Institute's Brain Resources and Information Network (BRAIN) at:

BRAIN
P.O. Box 5801
Bethesda, MD 20824
301-496-5751
800-352-9424
www.ninds.nih.gov

A listing of clinical trials involving headache research can be found at <http://ClinicalTrials.gov>, an easy-to-use Web site that provides regularly updated information about federally and privately supported clinical trials for a wide range of neurological and other disorders and conditions.

A number of private organizations offer a variety of services and information that can help those affected by headache. They include:

American Headache Society
Committee for Headache Education (ACHE)
19 Mantua Road
Mt. Royal, NJ 08061
856-423-0258
800-255-ACHE (2243)
www.achenet.org

American Pain Foundation
201 North Charles Street
Suite 710
Baltimore, MD 21201
888-615-PAIN (7246)
www.painfoundation.org

Migraine Research Foundation
434 ½ East 75th Street
New York, NY 10021
212-249-5402
www.migraineresearchfoundation.org

National Headache Foundation
820 North Orleans
Suite 217
Chicago, IL 60610
312-274-2650
888-NHF-5552 (643-5552)
www.headaches.org

Glossary

abdominal migraine—a type of migraine that mostly affects young children and involves moderate to severe abdominal pain, with little or no headache.

arteriovenous malformation—a tangle of veins and arteries that can disrupt the normal flow of blood and is frequently associated with episodic headache.

aura—a warning of a migraine headache. Usually visual, it may appear as flashing lights, zigzag lines, or a temporary loss of vision, along with numbness or trouble speaking.

autonomic—occurring involuntary. Autonomic nervous system dysfunction is frequently associated with various types of migraine.

basilar-type migraine—a type of migraine, occurring primarily in young women, causing symptoms of abnormal brain stem functioning such as double vision, loss of peripheral vision, numbness, imbalance, or loss of consciousness.

benign intracranial hypertension—increased pressure within the brain that causes severe headaches. It can be caused by clotting in the major cerebral veins or from certain medications (including some antibiotics, human growth hormone replacement, and vitamin A and related compounds).

biofeedback—a process that increases an individual's voluntary control of physiologic states such as blood pressure and pain response.

cephalgia—head pain.

cervical arterial dissection—a tear in an artery wall that can lead to stroke or transient ischemic attacks.

cervicogenic headache—a type of headache caused by structural irregularities in either the neck or head.

chronic headache—headache that occurs 15 or more days a month over a 3-month period.

cluster headache—sudden, extremely painful headaches that occur in a closely grouped pattern several times a day and at the same times over a period of weeks.

cortical spreading depression—a wave of increased brain activity that slowly spreads from the back toward the front of the brain's surface and may be the basis for migraine aura.

episodic—comes and goes.

ergot derivative drugs—drugs that bind to the neurotransmitter serotonin and help to decrease the transmission of pain messages along nerve fibers.

hematoma—a mass or swelling containing blood.

hemicrania continua—one-sided headaches that are chronic or continuous and respond to indomethacin treatment.

hemiplegic migraine—a type of migraine causing temporary paralysis on one side of the body.

hypnic headache—a rare form of headache that awakens individuals at night (also called “alarm-clock headache”).

ice cream headache—a painful headache brought on by changes in blood flow that result from a sudden chilling of the roof of the mouth.

ischemic stroke—stroke caused by a clot that blocks blood flow to the brain.

medication overuse headache—caused by the overuse of drugs (more than 3 times weekly) to treat headache; over time, the underlying headache becomes worse and occurs more frequently, creating a vicious cycle of medication use and head pain.

meninges—the three layers of membrane that cover the brain and spinal cord.

menstrually related migraine—a migraine that affects women around the time of their period.

migraine—headaches that are usually pulsing or throbbing and occur on one or both sides of the head. They are moderate to severe in intensity, associated with nausea, vomiting, sensitivity to light and noise, and worsen with routine physical activity.

new daily persistent headache—a type of treatment-resistant chronic headache marked by daily pain that can last for years.

neurotransmitters—chemicals in the brain that helps nerve cells communicate with each other.

nociceptors—nerve fiber endings that receive and transmit pain signals.

ophthalmoplegic migraine—an uncommon form of migraine featuring a droopy eyelid, large pupil, and double vision that may last for weeks after the headache pain is gone.

paroxysmal hemicrania—a rare form of headache that usually begins in adulthood and is marked by one-sided attacks that typically occur 5 to 40 times a day.

postdrome—the period following the headache.

premonitory—meaning before. Some individuals with migraine experience premonitory symptoms up to 24 hours prior to headache pain.

primary exertional headache—headache brought on by fits of coughing or sneezing, or by intense physical activity such as running or lifting.

primary headaches—headaches that occur on their own with no detectable underlying cause, such as migraine, tension-type headache, and the trigeminal autonomic cephalgias.

primary stabbing headache—also called “ice pick headache” or “jabs and jolts” headache for its extremely intense pain that develops suddenly and generally lasts 1 to 10 seconds.

retinal migraine—a type of migraine that is characterized by attacks of visual loss or disturbances in one eye.

reversible vasoconstriction syndrome—a narrowing of the arteries in the brain that can cause sudden, “thunderclap” headache that may be brought on by bleeding in or around the brain.

secondary headaches—headaches that are caused by an underlying condition or disease.

serotonin—a neurotransmitter present throughout the body and brain that plays an important role in headache and migraine, mood disorders, regulating body temperature, sleep, vomiting, sexuality, and appetite.

status migrainosus—migraine lasting more than 72 hours.

SUNCT (**S**hort-lasting, **U**nilateral, **N**euralgiform headache attacks with **C**onjunctival injection and **T**earing)—a rare form of headache marked by brief recurrent bursts of moderate to severe burning, stabbing, or throbbing pain, usually on one side of the head and around the eye or temple, accompanied by symptoms including watery, reddish eyes and runny nose.

tension-type headache—a primary headache that is band-like or squeezing and does not worsen with routine activity. It may be brought on by stress.

transient ischemic attack—a stroke that last only a few minutes but signals a subsequent and more severe stroke.

trigger—something that brings about a disease or condition.

triptans—a family of drugs used to treat migraines and cluster headaches by preventing or stopping nerve tissue inflammation and resulting changes in blood vessels.

vascular—refers to blood vessels or the flow of blood.

venous sinus thrombosis—a form of stroke caused by a clot that blocks blood flow in the brain's veins.

Credits

Illustrations and photos:

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Page 36, Dr. Rami Burstein

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Why does bright light or noise hurt when you have a headache? Why is sleep important? How does stress cause headache? Basic research tries to answer questions like these as we learn how messages are sent and influence different parts of the brain. Findings from such studies can lead to improved patient care and headache prevention.



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