NERVOUS SYSTEM STIMULANTS

A person's state of mental alertness varies throughout the day and is under the control of chemicals in the brain, some of which are depressant, causing drowsiness, and others that are stimulant, heightening awareness.

It is thought that an increase in the activity of the depressant chemicals may be responsible for a condition called narcolepsy, which is a tendency to fall asleep during the day for no obvious reason. In this case, the nervous system stimulants are administered to increase wakefulness. These drugs include the amphetamines (usually dexamfetamine), the related drug methylphenidate, and modafinil. Amphetamines are used less often these days because of the risk of dependence. A common home remedy for increasing alertness is caffeine, a mild stimulant that is present in coffee, tea, and cola. Respiratory stimulants related to caffeine are used to improve breathing (see right).

Why they are used

In adults who suffer from narcolepsy, some of these drugs prevent excessive drowsiness during the day. Stimulants do not cure narcolepsy and, since the disorder usually lasts throughout the sufferer's lifetime, may have to be taken indefinitely. Methylphenidate or dexamfetamine are sometimes given to children suffering from attention deficit hyperactivity disorder (ADHD). Stimulants were once used as part of the treatment for obesity because reduced appetite is a side effect of amphetamines but they are no longer thought appropriate for weight reduction. Diet is now the main treatment, together with orlistat if necessary.

Caffeine is added to some analgesics to counteract the effects of caffeine withdrawal which can cause headaches, but no clear medical justification exists for this.

Apart from their use in narcolepsy, nervous system stimulants are not useful in the long-term because the brain soon develops tolerance to them.

How they work

The level of wakefulness is controlled by a part of the brain stem called the reticular activating system (RAS). Activity in this area depends on the balance between chemicals, some of which are excitatory (including norepinephrine (noradrenaline)) and some inhibitory, such as gamma aminobutyric acid (GABA). Stimulants promote release of noradrenaline increasing activity in the RAS and other parts of the brain, so raising alertness.

How they affect you

In adults, the central nervous system stimulants taken in the prescribed dose for narcolepsy increase wakefulness, thereby allowing normal concentration and thought processes to occur. They may also reduce appetite and cause tremors. In hyperactive children, they reduce the general level of activity to a more normal level and increase the attention span.

Risks and special precautions

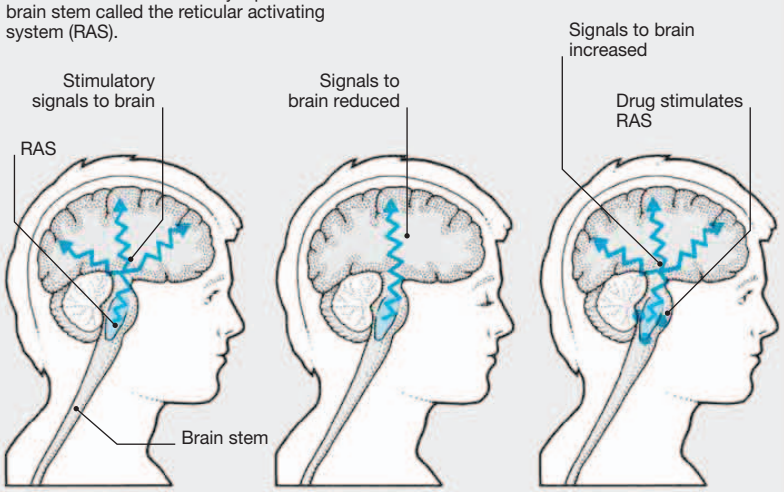
Some people, especially the elderly or those with previous psychiatric problems, are particularly sensitive to stimulants and may experience adverse effects, even when the drugs are given in comparatively low doses. They need to be used with caution in children because they can retard growth if taken for prolonged periods. An excess of these drugs given to a child may depress the nervous system, producing drowsiness or even loss of consciousness. Palpitations may also occur.

These drugs reduce the level of natural stimulants in the brain, so after regular use for a few weeks a person may become physically dependent on them for normal function. If they are abruptly withdrawn, the excess of natural inhibitory chemicals in the brain depresses central nervous system activity, producing withdrawal symptoms. These may include lethargy, depression, increased appetite, and difficulty staying awake.

Stimulants can produce overactivity in the brain if used inappropriately or in excess, resulting in extreme restlessness, sleeplessness, nervousness, or anxiety. They also stimulate the sympathetic branch of the autonomic nervous system (see p.35), causing shaking, sweating, and palpitations. More serious risks of exceeding the prescribed dose are fits and a major disturbance in mental functioning that may result in delusions and hallucinations. Because these drugs have been abused, amphetamines and methylphenidate are classified as controlled drugs (see p.13).

ACTION OF NERVOUS SYSTEM STIMULANTS

Wakefulness is controlled by a part of the brain stem called the reticular activating system (RAS).



Normal brain activity
When the brain is functioning normally, signals from the RAS stimulate the upper parts of the brain, which control thought processes and alertness.

Brain activity in narcolepsy
In narcolepsy, the level of signals from the RAS is greatly reduced.

Normal brain activity restored
Central nervous system stimulants act on the RAS to increase the level of stimulatory signals to the brain.

RESPIRATORY STIMULANTS

Some stimulants (for example, aminophylline, theophylline, and doxapram) act on the part of the brain – the respiratory centre – that controls respiration. They are sometimes used in hospitals to help people who have difficulty breathing, mainly very young babies and adults with severe chest infections.

COMMON DRUGS

Respiratory stimulants
Doxapram
Theophylline/ aminophylline ⁕

Other drugs
Atomoxetine
Caffeine
Dexamfetamine
Methylphenidate ⁕
Modafinil ⁕

⁕ See Part 3