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Erectile Dysfunction (ED)

(Impotence)

*By **Irvin H. Hirsch**, MD, Sidney Kimmel Medical College of Thomas Jefferson University*

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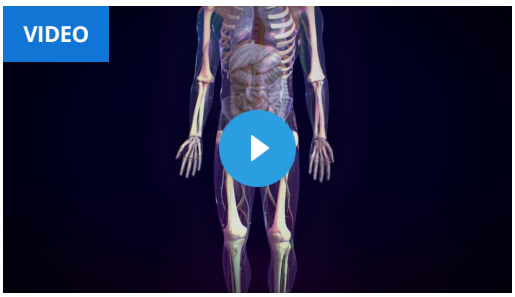
Erectile dysfunction (ED) is the inability to attain or sustain an erection satisfactory for sexual intercourse.

(See also Overview of Sexual Dysfunction in Men.)
Every man occasionally has a problem achieving an erection, and such occurrences are considered normal. Erectile dysfunction (ED) occurs when a man is

- Never able to achieve an erection
- Achieves erection briefly but not long enough for intercourse
- Achieves effective erection inconsistently

ED is called primary if the man has never been able to attain or sustain an erection.
ED is called secondary if it is acquired later in life by a man who was previously able to attain erections.
Secondary ED is much more common than primary ED.
In the United States, about 50% of men aged 40 to 70 are affected somewhat, and the percentage increases with aging. However, ED is not considered a normal part of aging and can be successfully treated at any age.

The Penis and Urethra



Causes

To achieve an erection, the penis needs an adequate amount of blood flowing in, a slowing of blood flowing out, proper function of nerves leading to and from the penis, adequate amounts of the male sex hormone testosterone, and sufficient sex drive (libido), so a disorder of any of these systems may lead to erectile dysfunction (ED).
Most cases of ED are caused by abnormalities of the blood vessels or nerves of the penis. Other possible causes include hormonal disorders, structural disorders of the penis, use of certain drugs, and psychologic problems (see table Common Causes and Features of Erectile Dysfunction). The most common specific causes are

- Hardening of the arteries (atherosclerosis) that affects the arteries to the penis
- Diabetes mellitus

Complications of prostate surgery

Certain drugs such as those used to treat high blood pressure or an enlarged prostate and those that act on the central nervous system, such as drugs used to treat depression

Did You Know...

Occasional inability to achieve an erection is normal and does not mean that a man has erectile dysfunction.

Almost half of men older than 65 and some men older than 80 can usually have erections adequate for penetration.

Low levels of testosterone tend to decrease sex drive rather than cause erectile dysfunction.

Combinations of drugs injected into the penis and devices that constrict or apply suction to the penis are highly effective and lack some of the side effects of oral drugs.

Sexual counseling can help even when erectile dysfunction has a physical cause.

Often several factors contribute to ED. For example, a man with a slight decrease in erectile function caused by diabetes or peripheral vascular disease can develop severe ED after starting a new drug or if stress increases.

Blood vessel disorders

Atherosclerosis may partially block blood flow to the legs (peripheral vascular disease). Usually, arteries to the penis are also blocked, decreasing the amount of blood flow to the penis and causing ED. Diabetes, high cholesterol levels, high blood pressure, and smoking contribute to atherosclerosis and therefore to ED.
Sometimes blood leaks out of the veins in the penis too fast, decreasing blood pressure in the penis and thus interfering with achieving or maintaining an erection (called veno-occlusive dysfunction).

Nerve disorders

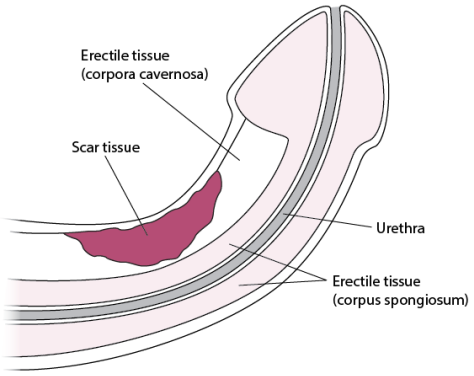
If the nerves sending messages to the penis are damaged, ED can occur. In addition to causing atherosclerosis, diabetes can also affect the nerves that supply the penis. Because nerves to the penis run along the prostate gland, prostate surgery (such as for cancer or an enlarged prostate) often causes ED.
Less common nerve disorders that cause ED include spinal cord injury, multiple sclerosis, and stroke. Also, prolonged pressure on the nerves in the buttocks and genital area (the so-called saddle area), as may occur during long-distance bicycle riding, can cause temporary ED.

Other disorders

Hormonal disturbances (such as abnormally low levels of testosterone) tend to decrease sex drive but can also result in ED.
In **Peyronie disease**, scar tissue develops inside the penis, resulting in curved and often painful erections and causing ED.

What Is Peyronie Disease?

In Peyronie disease, inflammation inside the penis causes scar tissue to form. Because the scar tissue does not enlarge during an erection, the erect penis is curved, making penetration during sexual intercourse difficult or impossible. The scar tissue may extend into the erectile tissue (corpora cavernosa), causing erectile dysfunction.



Drugs, including alcohol and illicit drugs such as cocaine and amphetamines, can also cause or contribute to ED.
Sometimes **psychologic problems** (such as performance anxiety or depression) or factors that decrease a man's energy level (such as illness, fatigue, or stress) cause or contribute to ED. Erectile dysfunction may be situational, involving a particular place, time, or partner.
Prolonged, painful erection (priapism) may damage the erectile tissue of the penis, leading to ED.

Evaluation

An occasional episode of erectile dysfunction (ED) is not uncommon, but men who are consistently unable to achieve or maintain an erection should see their doctor because ED may be a sign of a serious health problem, such as atherosclerosis or a nerve disorder. Most causes of ED are treatable. The following information can help men know when to see a doctor and what to expect during the evaluation.

Warning signs

In men with ED, certain symptoms and characteristics are cause for concern. They include

- Absence of erections during the night or upon awakening in the morning
- Numbness in the area between and around the buttocks and genital area (called the saddle area)
- Painful cramping in the muscles of the legs that occurs during physical activity but is relieved promptly by rest (claudication)

When to see a doctor

Although ED may diminish a man's quality of life, it is not itself a dangerous condition. However, ED may be a symptom of a serious medical disorder. Because numbness in the groin or leg can be a sign of spinal cord damage, men who suddenly develop such numbness should see a doctor right away. Men who have other warning signs should call their doctor and ask how soon they need to be seen and examined.

What the doctor does

Doctors first ask questions about the man's symptoms and medical history. Doctors then do a physical examination. What they find during the history and physical examination often suggests a cause for ED and additional tests that may need to be done (see table Common Causes and Features of Erectile Dysfunction).

Doctors ask about

- Drug and alcohol use
- Smoking history
- History of diabetes
- History of high blood pressure
- History of atherosclerosis
- History of surgery (for example, for prostate enlargement, prostate or rectal cancer, or blood vessel disorders)
- History of injury (for example, a broken pelvic bone or a back injury)
- Symptoms of disorders of the blood vessels (for example, pain in the calves when walking or coolness, numbness, or blue color of the feet)
- Symptoms of nerve disorders (for example, numbness, tingling, weakness, incontinence, or falling)
- Symptoms of hormonal disorders (for example, loss of sex drive, increased size of breasts, decreased size of testes, loss of body hair, tremor, changes in weight or appetite, or difficulty tolerating heat or cold)
- Symptoms of psychologic disorders, particularly depression
- Satisfaction with sexual relationships
- Sexual dysfunction (for example, vaginitis or depression) in the man's partner

Even though men may be embarrassed to talk to their doctors about some of these subjects, the information is important in determining the cause of ED.

The physical examination focuses on the genitals and prostate, but doctors also look for signs of hormonal, nerve, and blood vessel disorders and examine the rectum.

The cause is sometimes clear from the history. For example, ED may occur soon after prostate surgery or beginning a new drug. One important clue is whether erections are present at night or on awakening. When erections are present, a physical cause is less likely than a psychologic cause because physical causes typically inhibit erections at all times. Other factors that suggest a psychologic cause are sudden development in a young healthy man, occurrence of symptoms only in certain situations, and resolution of ED without any treatment. Claudication or coolness or a blue color in the toes or feet may indicate a problem with the blood vessels such as peripheral vascular disease or vascular disease caused by diabetes.

Common Causes and Features of Erectile Dysfunction

Cause	Common Features*	Tests†
Blood vessel disorders		
Blockage of arteries (peripheral vascular disease)	Claudication (painful, aching, cramping, or tired feeling in the muscles of the legs that occurs regularly and predictably during physical activity but is relieved promptly by rest) Usually risk factors (for example, high blood pressure, diabetes, or abnormal blood levels of cholesterol and lipids)	Comparison of blood pressures measured in the ankle and arm at the same time (called the ankle-brachial index) Testing for risk factors (for example, elevated blood glucose [sugar] and blood lipid levels) Ultrasonographic measurement of blood flow in the arteries of the penis
Venous leak (when the veins in the penis cannot prevent blood from leaving the penis during an erection, as they normally do)	Erections that occur but cannot be sustained	Ultrasonographic testing of the arteries of the penis
Nerve disorders		
Nerve damage caused by diabetes (diabetic neuropathy)	Known diabetes Sometimes numbness, burning, or other pains of the feet Sometimes urinary incontinence	A doctor's examination Sometimes electromyography and nerve conduction studies
Multiple sclerosis	Intermittent episodes of weakness or numbness in different parts of the body at different times	MRI Sometimes spinal tap (lumbar puncture) and tests of spinal fluid
Nerve injury during pelvic surgery or radiation therapy	Known surgery (such as radical prostatectomy) or radiation therapy	Only a doctor's examination
Spinal cord disorders (such as tumors or injuries)	Numbness in the area between the penis and anus Usually other symptoms of spinal cord disorder (for example, numbness and weakness of legs and incontinence)	MRI
Prolonged pressure in the buttocks and genital area (the so-called saddle area), as occurs when riding a bicycle or a horse	Usually competitive athletes who bicycle for long periods Symptoms occur shortly after riding	Only a doctor's examination
Prostatitis (inflammation of the prostate)	Pain in the pelvic or groin area and bothersome urinary symptoms, such as pain, a burning sensation, blood in the urine, having to urinate frequently, or having difficulty starting to urinate	Only a doctor's examination
Stroke	Known stroke	Only a doctor's examination
Hormonal disorders		
Hypogonadism (testosterone deficiency)	Loss of sex drive, sleep disturbances, and depression or mood changes Eventually, decreases in the size of muscles and testes, bone density, and body hair Eventually, an increase in body fat and breast size	Measurement of the testosterone level in the blood

* Features include symptoms and the results of the doctor's examination. Features mentioned are typical but not always present.

† Testosterone level is usually measured. If the level is low, doctors measure levels of other hormones.

ED = erectile dysfunction; MRI = magnetic resonance imaging.

Cause	Common Features*	Tests†
Cushing syndrome	Round face, increased body fat in the trunk, purple streaks on the abdomen, high blood pressure, and mood changes	Measurement of levels of cortisol in the urine Sometimes blood tests
Severe hyperthyroidism (thyroid hormone excess)	Restlessness, increased heart rate and blood pressure, tremor, weight loss, and inability to tolerate heat	Measurement of levels of thyroid hormone in the blood
Severe hypothyroidism (thyroid hormone deficiency)	Sluggishness, decreased heart rate and blood pressure, thickened skin, decreased appetite, weight gain, and inability to tolerate cold	Measurement of levels of thyroid hormone in the blood
Structural disorders		
Peyronie disease (formation of scar tissue in the erectile tissue of the penis)	Firm tissue in the penis Often severe curving of the penis during erection Often pain during intercourse	Only a doctor's examination Ultrasonography of the penis to detect scar tissue
Hypospadias (a birth defect)	Urethra located on the underside of the penis	Only a doctor's examination
Microphallus (a birth defect)	Abnormally small penis	Only a doctor's examination
Psychologic disorders		
Depression	Sadness, helplessness, hopelessness, loss of appetite, and problems sleeping	Only a doctor's examination
Performance anxiety or stress	Full erections during sleep and when masturbating Concern about sexual performance Sometimes ED occurring only with certain partners or in certain situations	Only a doctor's examination
Other		
Drugs (see table Some Commonly Used Drugs That Can Cause Erectile Dysfunction)	History of taking a drug known to cause ED	Only a doctor's examination
Hypoxemia (chronically low blood oxygen levels)	Usually a chronic lung disorder (for example, chronic obstructive pulmonary disease)	Pulse oximetry (measurement of the level of oxygen in the blood)

* Features include symptoms and the results of the doctor's examination. Features mentioned are typical but not always present.

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Some Commonly Used Drugs That Can Cause Erectile Dysfunction

Class	Drugs
Drugs to treat high blood pressure (antihypertensives)	Beta-blockers (such as atenolol, carvedilol, metoprolol, and propranolol) Clonidine Diuretics (such as furosemide, hydrochlorothiazide, and chlorthalidone) Methyldopa Spironolactone
Drugs to treat prostate enlargement	Alpha-adrenergic blockers (such as terazosin, doxazosin, tamsulosin, and silodosin) 5-Alpha-reductase inhibitors (such as finasteride and dutasteride)
Drugs to treat prostate cancer	Hormonal drugs (such as leuprolide, triptorelin, and goserelin) Abiraterone Bicalutamide Ketoconazole
Drugs that affect the central nervous system	Alcohol Benzodiazepines (such as alprazolam, chlordiazepoxide, diazepam, and lorazepam) Cocaine or amphetamines, with chronic use Monoamine oxidase inhibitors (such as phenelzine, selegiline, and tranylcypromine) Opioids (such as codeine, heroin, hydromorphone, methadone, morphine, or oxycodone), if used chronically Selective serotonin reuptake inhibitors (such as citalopram, escitalopram, fluoxetine, paroxetine, and sertraline) Tricyclic antidepressants (such as amitriptyline, desipramine, imipramine, and nortriptyline)
Other	Androgen antagonists (such as megestrol) Anticancer drugs (most cancer chemotherapy drugs) Cimetidine Drugs with anticholinergic effects (such as many antihistamines and some antidepressants) Estrogens

Testing

Testing is usually needed. Laboratory tests include the measurement of the level of testosterone in the blood. If the testosterone level is low, doctors measure additional hormones. Depending on the results of the history and physical examination, blood tests may also be done to check for previously unrecognized diabetes, thyroid disorders, and lipid disorders. Usually, these tests provide doctors with enough information to plan treatment.

Occasionally, doctors inject a drug into the penis that stimulates erection and then use ultrasonography to assess blood flow in the arteries and veins of the penis. Rarely, doctors may recommend the use of a home monitor that detects and records erections during sleep.

Treatment

- Treatment of underlying causes
- Education and counseling
- Oral phosphodiesterase inhibitors
- Sometimes other drugs, mechanical devices, or surgery

Any underlying disorder is treated, and doctors often stop drugs that may be causing erectile dysfunction (ED) or switch the man to a different drug. However, men should talk with their doctor before they stop taking any drug.

Excess weight is a risk factor for many disorders that may cause ED, so weight loss may improve erectile function. Smoking is a risk factor for atherosclerosis, so stopping smoking may also improve erectile function. Stopping or decreasing alcohol use, if excessive, can also help.

Even ED caused by a physical disorder usually has a psychologic component, so doctors offer reassurance and education (including of the man's partner whenever possible). Couples counseling by a qualified sex therapist can help improve partner communication, reduce performance pressure, and resolve interpersonal conflicts that contribute to ED.

Supplemental testosterone can help restore erections in men with low testosterone levels. These testosterone preparations can be applied daily as a patch or a gel. Testosterone nasal products and below-the-skin implants are also sometimes recommended. Men with very low testosterone levels may need testosterone injections twice per month.

Noninvasive methods (mechanical devices and drugs) are tried first. Sometimes men must try the method a few times before doctors can determine whether it is effective. Usually, oral drugs are tried first. Drugs injected into the penis just before intercourse are effective and often tried second. Although most men prefer drugs to other methods of treating ED, mechanical devices have the advantages of being highly effective and, because they are free of drug side effects, usually very safe. Penile implant surgery with an inflatable prosthesis is the last used, but most effective, way to achieve intercourse.

Mechanical devices

Men who can develop but not sustain an erection may use a constriction ring. As soon as erection occurs, an elastic ring is placed around the base of the penis, helping prevent blood from flowing out and maintaining the firmness of the penis. If the man cannot develop an erection, a hand-held vacuum erection device can be applied over the penis. This device draws blood into the penis by exerting a gentle vacuum effect, after which the ring is placed on the base of the penis to retain the erection. Bruising of the penis, coldness of the tip of the penis, and lack of spontaneity are some drawbacks to this method. Sometimes a constriction ring and vacuum device are combined with drug therapy.

Drugs

The primary drugs for ED are oral phosphodiesterase inhibitors. Other drugs include prostaglandins that are injected into the penis or inserted into the urethra. Oral phosphodiesterase inhibitors are used much more often than other drugs because they are simple to use and allow spontaneity in intercourse. Over-the-counter herbal remedies are sold for ED, but they are usually ineffective, contain hidden doses of a phosphodiesterase inhibitor, or both. The hidden phosphodiesterase inhibitor may expose the man to a drug with possible side effects.

Oral phosphodiesterase inhibitors (sildenafil, vardenafil, avanafil, and tadalafil) increase blood flow to the penis. These drugs work in the same way, but differ as to how long the effect lasts, their side effects, and their interactions with food. The effect of tadalafil lasts longer than those of the other drugs (up to 36 hours), which some men prefer.

Most phosphodiesterase inhibitors work best when taken on an empty stomach and at least 1 hour before sexual intercourse. Men who are taking nitrates (most often nitroglycerin for the treatment of angina but also recreational amyl nitrate ["poppers"]) should not take phosphodiesterase inhibitors because the combination can cause blood pressure to drop to unsafe levels. Other temporary side effects of phosphodiesterase inhibitors include flushing, vision abnormalities (including abnormal color perception), and headache. Priapism (prolonged erection) develops very rarely and may require emergency medical treatment. In rare instances, men have reported blindness or hearing loss after taking phosphodiesterase inhibitors, but it is not clear whether the phosphodiesterase inhibitors have been the cause.

Alprostadil (the prostaglandin PGE1) alone or in combination with papaverine and phentolamine may be directly injected into the side of the penis using a very thin needle, causing a suitable erection in most men. Alprostadil suppository may be inserted into the urethra using a straw-like applicator. These therapies may cause priapism and penile pain. Usually, the doctor guides the man to administer the drug himself during an office visit. After this, men may give themselves these drugs at home. Alprostadil suppository may be combined with an oral phosphodiesterase inhibitor for men in whom oral drugs are not effective.

Surgery

For some men, drug therapy is not effective or acceptable. In these men, surgery to implant a penile prosthesis may be done. Prostheses can take the form of rigid silicone rods or hydraulically operated devices that can be inflated and deflated. Both involve the risks of general anesthesia, infection, and prosthetic malfunction.

Essentials for Older People: Erectile Dysfunction

Although erectile dysfunction (ED) does increase with aging, it need not be accepted as a normal part of aging. Rather, because older men are more likely to have medical conditions that affect the blood vessels they are also more likely to

have ED. Many older couples engage in satisfying sexual activity without erections or intercourse and may not choose to seek treatment. Nevertheless, treatment of ED can be appropriate for older men.

Key Points

ED commonly results from psychologic, nervous system, or blood vessel disorders, from injury, or from the side effects of some drugs or surgery.

When considering the causes, doctors consider psychologic and interpersonal factors.

Testosterone therapy may help restore erectile function in men with low serum testosterone levels and ED, but a low testosterone level is not a common cause of ED.

Most men with ED may be successfully treated with an oral phosphodiesterase inhibitor such as sildenafil, vardenafil, avanafil, or tadalafil.

Most men who do not respond to therapy with oral phosphodiesterase inhibitors can achieve erections with injections of alprostadil, either alone or combined with an oral phosphodiesterase inhibitor.

Vacuum erection devices and penile prosthesis surgery are effective treatments for men with severe ED.