

# Erectile dysfunction

Haley Smith, BPharm

Amayeza Info Centre

Correspondence to: Haley Smith, e-mail: [haley@amayeza-info.co.za](mailto:haley@amayeza-info.co.za)

## Abstract

Erectile dysfunction (ED) is a medical term that describes the inability to achieve and/or maintain an erect penis adequate for sexual function. This condition is one of the most common sexual problems for men and increases with age, but it's not a natural part of ageing. Approximately one half of men aged 40 years and older have erection problems. Most men have difficulty achieving an erection from time to time, and such occurrences are considered normal. However, ED may be a regular and more severe problem in some men. It can cause low self-esteem, performance anxiety, depression and stress, and may also affect the quality of a marriage or intimate relationships. Lifestyle changes, such as losing weight, participating in more exercise, stopping smoking and minimising the risk of heart disease, may help to improve the condition. The introduction of the phosphodiesterase type 5 inhibitors has revolutionised the treatment of ED. Surgery may be considered when these inhibitors and other approaches fail or are contraindicated.

**Keywords:** erectile dysfunction, sexual function, common sexual problems, men

## Introduction

Erectile dysfunction (ED) is defined as the consistent or recurrent inability to acquire or sustain an erection of sufficient rigidity and duration for sexual intercourse.<sup>1</sup> ED occurs when a man:<sup>2</sup>

- Is never able to achieve an erection
- Achieves an erection briefly, but not long enough for intercourse to occur
- Achieves an effective erection inconsistently.

## How do erections occur?

When a man is not sexually aroused, his penis is soft, limp or flaccid. During sexual arousal, nerve messages release chemicals that increase blood flow to the penis. The blood flows into two erection chambers made of spongy tissue (the *corpus cavernosum*) in the penis. The "smooth muscle" in the erection chambers relaxes, which allows blood to enter and remain in the chambers (Figure 1). The pressure of the blood in the chambers makes the penis firm, producing an erection.<sup>3</sup> The erection ends when muscles in the penis contract to stop the inflow of blood and open the veins for blood outflow.<sup>4</sup>

The arteries (top) and veins (bottom) penetrate the *corpora cavernosa* and the *corpus spongiosum*. An erection occurs when the relaxed muscles allow the *corpora cavernosa* to fill with excess blood fed by the arteries, while drainage of blood through the veins is blocked by the *tunica albuginea*.<sup>4</sup>

## What are the risk factors for erectile dysfunction?

The most common risk factors for ED include:<sup>1-4</sup>

- Being older than 40 years of age
- Cardiovascular disease
- High blood pressure
- High cholesterol
- Diabetes mellitus
- Obesity
- Smoking
- Co-morbid conditions
- The use of certain medications
- Obstructive sleep apnoea
- Restless leg syndrome

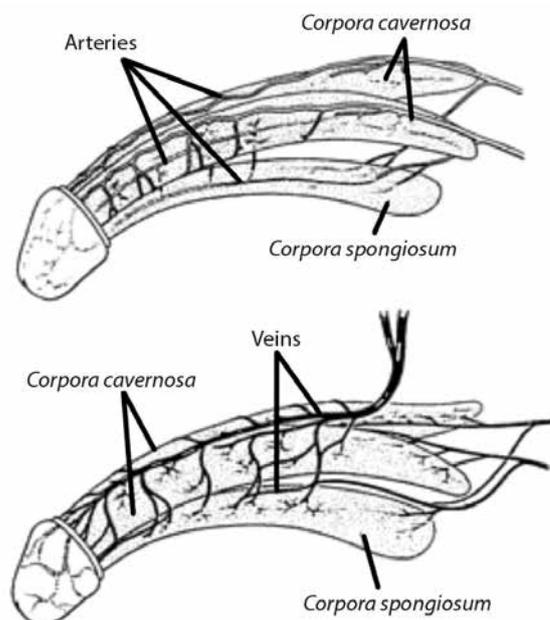


Figure 1: Arteries and veins of the penis<sup>4</sup>

- Sleep disorders
- Inactivity or lack of exercise
- A sedentary lifestyle
- Prostate surgery complications.

### What causes erectile dysfunction?

Achieving a normal erection is a complex process involving psychological impulses from the brain; adequate levels of the male sex hormone, testosterone; a functioning nervous system and adequate and healthy vascular tissue in the penis.<sup>3</sup> A disorder of any of these systems may lead to ED.<sup>2,3</sup>

Although ED is more common as men age, growing old is not the cause of the problem.<sup>5</sup> Approximately eight in 10 cases of ED are due to a physical cause.<sup>6</sup> ED may also result from health or emotional problems, or from both combined. It can be an early sign of a more serious health problem. Finding and treating its causes may improve overall health and well-being.<sup>5</sup>

### Physical causes

#### Reduced blood flow to the penis

Reduced blood flow to the penis is by far the most common cause of ED in men who are 40 years of age and older. As occurs in other parts of the body, the arteries which take blood to the penis can become narrowed. The blood flow may not be enough to cause an erection. Risk factors can increase the chances of narrowing of the arteries. These include high blood pressure, high cholesterol and smoking.<sup>6</sup>

#### Diseases which affect the nerves going to the penis

If the nerves sending messages to the penis are damaged, ED can occur. Less common nerve disorders that cause ED include spinal cord injury, multiple sclerosis, Parkinson's disease, dementia and strokes.<sup>1,2,6</sup> In addition, pelvic trauma, prostate surgery or priapism may cause ED.<sup>1</sup>

#### Hormonal causes

Testosterone plays an integral role in normal male sexual function.<sup>1</sup> Hormonal disturbances, such as abnormally low levels of circulating testosterone, tend to decrease the sex drive, but can also result in ED.<sup>2,3</sup> Sexual potency returns when testosterone levels normalise. Other disruptions in hormone secretion, including hyperprolactinaemia, hyperthyroidism and hypothyroidism, are commonly associated with ED. Restoration of the normal hormonal state usually results in the return of erectile function.<sup>1</sup>

#### Diabetes mellitus

Diabetes can affect the blood vessels and nerves.<sup>6</sup> The recognition that one third of men with type 2 diabetes mellitus have subnormal testosterone concentrations suggests that this hormone deficiency, and not just diabetic vasculopathy or neuropathy, may play a role in the ED seen in men with diabetes.<sup>1</sup>

### Injury to the nerves going to the penis

Spinal injury, surgery to the nearby structures, a fractured pelvis and radiotherapy to the genital area may cause injury to the nerves going to the penis.<sup>6</sup>

### Excessive outflow of blood from the penis

Sometimes, blood leaks out of the veins in the penis too fast, decreasing the blood pressure therein, and thus interfering with the man's ability to achieve or maintain an erection. This is called veno-occlusive dysfunction.<sup>2</sup>

### Cycling

Temporary ED after long-distance cycling is thought to be common. It is probably due to pressure on the nerves going to the penis, from sitting on the saddle for long periods. This may affect the function of the nerves after the ride.<sup>2,6</sup>

### Side-effects of certain medicines

It is estimated that 25% of cases of ED are due to medications.<sup>1</sup> Certain prescription drugs, such as ketoconazole, selective serotonin reuptake inhibitors, thiazide diuretics, spironolactone and cimetidine,<sup>1</sup> as well as alcohol and illicit drugs, such as cocaine and amphetamines, may cause or contribute to ED.<sup>2,6</sup>

### Diseases

Diseases associated with ED include Peyronie's disease, systemic sclerosis (scleroderma) and prostate cancer treatment, such as brachytherapy and prostatectomy.<sup>1</sup>

### Surgery

Surgery, especially radical prostate and bladder surgery for cancer, may also injure the nerves and arteries near the penis, causing ED. Injury to the penis, spinal cord, prostate, bladder and pelvis can lead to ED by harming the nerves, smooth muscles, arteries and the fibrous tissues of the *corpora cavernosa*.<sup>4</sup>

### Other

Interference with oxygen delivery or nitric oxide synthesis may prevent intracavernosal blood pressure from rising to a level sufficient to impede venous outflow, leading to an inability to acquire or sustain a rigid erection. Examples include decreased blood flow and inadequate intracavernosal oxygen levels when atherosclerosis involves the hypogastric artery or other feeder vessels. Low intracavernosal nitric oxide synthase levels are also found in cigarette smokers and patients with diabetes and testosterone deficiency, which may explain why these factors are associated with a high frequency of ED.<sup>1</sup>

### Psychological causes

Psychological problems, such as depression, performance anxiety or factors that decrease a man's energy levels, such as fatigue, illness or stress, may cause or contribute to ED. ED may be situational, involving a particular place, time or partner. 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 medicine or as a result of increased stress.<sup>2</sup>

The mind and body need to work together in order for sexual activity to occur. Psychological, emotional or relationship problems can cause or worsen ED and include the following:<sup>3,6</sup>

- Anxiety about sexual performance
- Stress at home or work
- Depression
- Relationship conflicts.

### Warning signs

Certain symptoms and characteristics are a cause for concern in men with ED, and include the following:<sup>2</sup>

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

### When to see a doctor

Although ED may diminish a man's quality of life, it is not a dangerous condition. However, it 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 immediately.<sup>2</sup>

To improve erection problems, the healthcare provider may need to treat the root causes. Making a few healthy lifestyle changes, such as stopping smoking, reducing alcohol consumption, losing excessive weight and increasing physical activity, may improve the condition.<sup>3,5</sup> Cutting back on or changing certain medications on the advice of the doctor can often improve ED.<sup>5</sup>

Psychotherapy and behaviour modification in selected patients should be considered next, if indicated, followed by oral or locally injected medicines, vacuum devices and surgically implanted devices. Surgery involving the veins or arteries may be considered in rare cases.<sup>3</sup>

### Medical treatments

#### Testosterone

If a blood test shows low testosterone levels, testosterone replacement therapy (TRT) may help to restore erectile function in men. However, if a blood test shows normal testosterone levels, adding TRT will not help erection problems.<sup>5</sup> TRT is often ineffective in these situations and inappropriate use may cause liver damage.<sup>4</sup>

#### Phosphodiesterase type 5 inhibitors

Oral medications, known as phosphodiesterase type 5 (PDE5) inhibitors, are the first line of therapy for uncomplicated ED. Most men with ED may be successfully treated with an oral PDE5 inhibitor, such as sildenafil, vardenafil or tadalafil.<sup>2</sup> These agents are potent, reversible and competitive inhibitors of PDE5.<sup>7</sup>

The aim of treatment is to achieve smooth muscle relaxation within the *corpora cavernosa*.<sup>8</sup> Medication is taken before beginning sexual activity and the treatment boosts the natural signals that are generated during sex, thereby improving and prolonging the erection.<sup>3</sup> PDE5 inhibitors relax the muscle cells in the penis and increase blood flow, creating a more rigid erection.<sup>5,6</sup>

Sildenafil, vardenafil and tadalafil are equally effective in mild to moderate ED. The choice of PDE5 inhibitor depends on the patient's requirements and the side-effect profile of the medicine. Most PDE5 inhibitors work best when taken on an empty stomach, and at least one hour before sexual intercourse.<sup>2</sup> Vardenafil is the quickest acting. Fifty-three per cent of men achieve an effective erection within 25 minutes. Tadalafil can be taken with meals, while vardenafil and sildenafil have delayed and reduced absorption when taken with a high-fat meal. Tadalafil is the longest lasting, with an efficacy that lasts up to 36 hours.<sup>8</sup>

These medicines are contraindicated in patients taking vasodilator nitrates because the combination can cause the blood pressure to drop to unsafe levels.<sup>2,7</sup> For example, PDE5 inhibitors should be used cautiously in men receiving an alpha-adrenergic blocker.<sup>1</sup>

Other temporary side-effects of phosphodiesterase inhibitors include headaches, a stuffy nose, muscle aches, and flushing and vision abnormalities (i.e. abnormal colour perception).<sup>2,3,8</sup> Priapism (prolonged erection) develops very rarely, and may require emergency medical treatment. In rare instances, men have reported blindness or hearing loss after taking PDE5 inhibitors, but it is not clear whether or not the PDE5 inhibitors were the cause.<sup>2,8</sup>

#### An intracavernosal injection

An intracavernosal injection was the mainstay of therapy in the past, but is now used infrequently.<sup>3</sup> While oral medicines improve the response to sexual stimulation, they do not trigger an automatic erection, as injections do. Many men achieve stronger erections by injecting drugs, such as alprostadil, into the penis.<sup>4</sup> Alprostadil (prostaglandin E<sub>1</sub>) inhibits alpha 1-adrenergic activity in the penis. It widens the blood vessels and increases blood flow to the penis, which helps to facilitate an erection.<sup>4,7</sup> The injectable form of alprostadil is marketed as Caverject<sup>®</sup>.<sup>4</sup> An erection is usually achieved within 5-10 minutes, but can take up to 30 minutes. The duration of action is dose related, and also pertains to the quality of the erectile tissue within the *corpora cavernosa*.<sup>8</sup>

An intracavernosal injection may create unwanted side-effects, including scarring of the penis and a prolonged erection, known as priapism.<sup>4</sup>

### Mechanical devices

#### Constriction ring

Men who can develop, but not sustain, an erection, may use a constriction ring. As soon as an erection occurs, an elastic ring is

placed around the base of the penis, to help prevent blood from flowing out and to maintain the firmness of the penis.<sup>2</sup>

### Vacuum device

If a man cannot develop an erection, a hand-held vacuum erection device can be applied over the penis. This device combines a plastic cylinder or tube that slips over it, making a seal with the skin of the body. A pump on the opposite end of the cylinder creates a low-pressure vacuum around the erectile tissue and draws blood into the penis, which results in an erection. To retain the erection once the plastic cylinder is removed, a rubber constriction band goes around the base of the penis, which maintains the erection for up to 30 minutes. With proper instruction, 75% of men can achieve a functional erection using a vacuum erection device.<sup>2,3-5</sup> The ring should be removed after that time to restore normal circulation and to avoid skin irritation.<sup>4</sup> Bruising of the penis, coldness at its tip, and lack of spontaneity are some drawbacks to this method.<sup>2</sup>

Sometimes a constriction ring and vacuum device are combined with medical therapy.<sup>2</sup>

### Surgery

The surgical management of ED should be reserved for men who cannot use, or who have not responded to, first- and second-line therapies.<sup>1</sup> Surgery, to implant a penile prosthesis, may be performed in these men (Figure 2). 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 anaesthesia, infection and prosthetic malfunction.<sup>2</sup>

Surgery usually has one of three goals<sup>4</sup>

- To implant a device that causes the penis to become erect
- To reconstruct arteries to increase blood flow to the penis
- To block off veins that allow blood to leak from the penile tissue.

With an inflatable implant, an erection is produced by squeezing a small pump implanted in the scrotum. The cylinders expand to create the erection.<sup>4</sup>

### Conclusion

The inability to achieve and maintain an erection sufficient for satisfactory sexual intercourse is a distressing and common symptom. The prevalence of ED increases with age, and is common in men with systemic disorders, such as hypertension, ischaemic heart disease or diabetes mellitus. The general

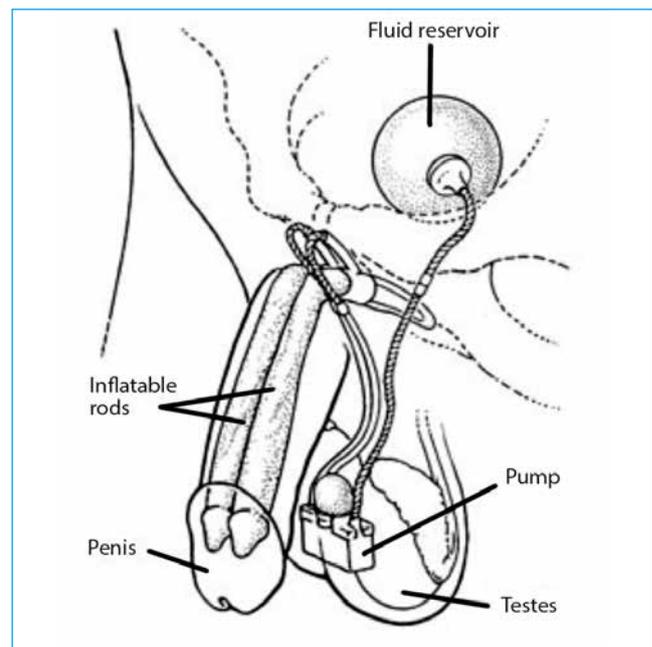


Figure 2: A surgical implant<sup>4</sup>

practitioner needs to be well informed of available treatment for ED, and should encourage high-risk patients to make healthy lifestyle choices, while also aiding men to regain sexual function.

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