

## Erectile dysfunction

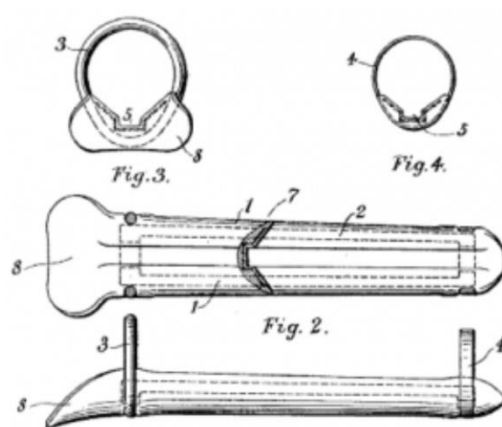
### Introduction

#### Definition and overview:

Erectile dysfunction is the continuous inability to achieve or maintain penial erection necessary for sex performance.

#### Historical context:

The history of erectile dysfunction (ED) extends for many centuries. With the improvement of different theories and methods, the very first recorded treatment was from 8<sup>th</sup> century BC in India. It was believed that sex with undesirable women causes ED, leading to treatments involves herbal medicines with animal-derived additives. However, in the beginning of the 20<sup>th</sup> century, John R. Brinkley controversially promoted goat testicle transplant as an ED treatment, which led to canceling his medical license. By the 1970s, penile implants and vacuum pumps became common, with Geddings Osbon's "youth equivalence device" paving the way for modern penis vacuum devices. In the 1980s, Dr. Giles Brindley's research on vasodilators laid the base for medicinal treatments. The big discovery came in the beginnings of the 1990s with the discovery of sildenafil (Viagra), which was initially developed as a heart medication. Pfizer launched Viagra in 1998, revolutionizing the treatment of ED and making it widely available, including over the counter and online options.



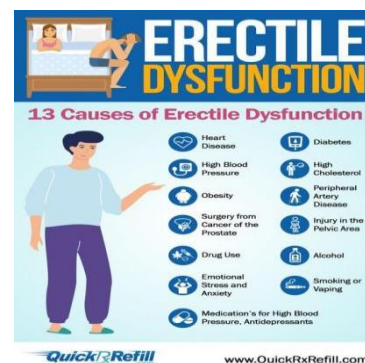
#### Epidemiology:

Erectile dysfunction affects nearly 10% of men whose age is between 40 to 70 years, in addition, 25% of them experiencing moderate or alternating difficulties. ED spreads increasingly with age, rising from 22% at age 40 to 49% at age 70. Despite it is less common in younger men, it stills affect 5% to 10% of those who are younger than 40.

### Etiology

#### Causes and risk factors:

There are many causes and risk factors for ED. But the most significant are the following: prostate problems, type 2 diabetes, high blood pressure, vascular disease/surgery, high levels of cholesterol, sleep disorders, drugs, neurogenic disorders, depression, alcoholism, and smoking.



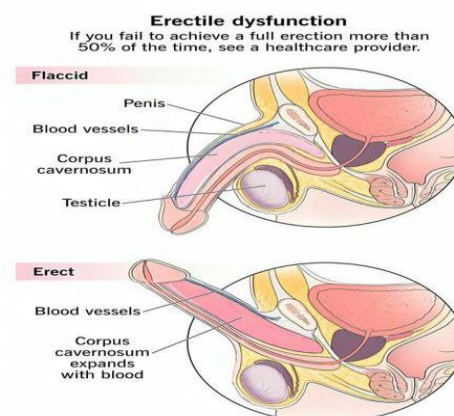
### Genetic and environmental influences:

Genetically, variation and mutation in some genes may incline people to ED. Natural environments don't have many influences on ED but some lifestyle choices like smoking, alcohol, and chronic and psychological factors can have a strong impact on ED.

### Clinical Features

#### Signs and symptoms:

The symptoms of ED are neither much nor complicated, and they are the following: disability of getting an erection, keeping it, and reduced sexual desire.



#### Disease stages and progression:

ED passes through various stages from weak to dangerous. At first, it may appear as random difficulty achieving an erection. As the state gets worse, these events become more frequent and constant, often related to health conditions like cardiovascular disease or diabetes. In many cases, individuals may experience a complete inability to achieve an erection.

#### Complications:

Some of the complications of the ED are the following: stress and anxiety, low self-esteem, fertility issues, relationships problems, and depression.

### Diagnosis

#### Diagnostic criteria:

Diagnostic criteria of ED involve reviewing ED symptoms, any medical conditions, medications/ drugs, and psychological factors.

#### Diagnostic tests and procedures:

Laboratory examinations like diabetes blood tests, testosterone levels...etc. In addition to some specialized tests like penile Doppler ultrasound or nocturnal penile tumescence.

### Differential diagnosis:

Differential diagnosis for ED includes but is not limited to the following: psychological disorders, cardiovascular conditions, endocrine and urological disorders, neurological conditions, medication side effects, bad lifestyle effects, and aging.

## Pathophysiology

### Mechanisms of disease development:

ED can develop by many ways, some of them are the following:

- Atherosclerosis, endothelial dysfunction, and hypertension reduce blood flow to the penis.
- Nerve damage or peripheral neuropathy impairs signal transmission for erections.
- Low testosterone and thyroid disorders affect libido and erectile function.
- Stress, anxiety, and depression interfere with the psychological arousal needed for an erection.
- Substance abuse and smoking impair sexual function.
- Natural age-related changes in vascular, neurological, and hormonal systems can contribute to ED.

### Cellular and molecular changes:

ED can cause some changes in the human body like: blood flow issues, vascular problems, muscle problems, hormonal changes, and inflammation.

### Impact on body systems:

ED impacts many body systems. Cardiovascular: it can indicate cardiovascular issues due to impaired blood flow. Hormonal: hormonal imbalances, such as low testosterone, can worsen ED. Nervous: Nerve damage from conditions like diabetes affects sexual arousal. Psychological: ED can lead to psychological issues such as stress, anxiety, and depression. Reproductive: ED directly impacts sexual function and intimacy. Musculoskeletal: ED potentially reducing physical activity and fitness.

## Management and Treatment

### Medical and surgical treatments:

Medical treatments include oral medications like sildenafil and tadalafil, hormone therapy, intraurethral suppositories, vacuum erection devices, and psychological counseling. Surgical

treatments involve penile implants (inflatable or malleable) and vascular surgery (bypass or revascularization) to improve blood flow and achieve erections.

### Pharmacological therapies:

Pharmacological therapies for erectile dysfunction (ED) include:

**Phosphodiesterase Type 5 Inhibitors (PDE5i):** Medications like sildenafil (Viagra), tadalafil (Cialis), vardenafil (Levitra), and avanafil (Stendra) improve blood flow to the penis.

**Hormone Therapy:** Testosterone replacement for men with low testosterone levels.

**Intracavernosal Injections:** Drugs like alprostadil injected directly into the penis to enhance blood flow.

**Intraurethral Therapy:** Alprostadil suppositories placed inside the urethra to induce an erection.



### Lifestyle and dietary modifications:

Some of the lifestyle and dietary modifications for ED are the following: regular exercise, weight management, quit smoking, limit alcohol drinking, managing stress, suitable sleeping amount, include healthy fats in food, and continuous hydration.

### Rehabilitation and supportive care:

ED rehabilitation and supportive care involve a comprehensive approach that includes medical management with medications, hormonal therapy, vacuum devices, or surgery, alongside psychological support through counseling or sex therapy. Lifestyle changes such as improving diet, exercise, quitting smoking, and reducing alcohol intake play a crucial role. Education about the condition and open communication with a partner are essential, as well as participating in support groups for additional emotional support and practical advice.



### Prevention and Control

#### Primary, secondary, and tertiary prevention strategies:

Primary prevention of ED includes building a healthy lifestyle and avoiding bad habits. It also includes managing stress and regular check-ups. Secondary prevention includes early detection, medical involvement, and psychological support. Tertiary prevention focuses on managing existing ED with medical treatments, continuous monitoring, and therapy.

### Public health interventions:

Public health interventions for ED include educational campaigns, improving healthcare access, developing healthy lifestyles, adding mental health support, training healthcare providers, and developing community programs.



### Vaccination and screening programs:

Currently, there are no vaccines for ED. Future research may discover vaccines for basic causes. Screening programs for the people who have ED focuses on evaluating risk factors, evaluating mental health, and increasing awareness.

## Prognosis

### Disease outcomes and survival rates:

A study involving 1,519 men with cardiovascular disease (CVD) from 13 countries discovered that those with erectile dysfunction (ED) faced significantly higher health risks compared to those without ED. Specifically, men with both CVD and ED were found to be 1.9 times more likely to die from cardiovascular disease, twice as likely to suffer a heart attack, 1.2 times more likely to be hospitalized for heart failure, and 1.1 times more likely to experience a stroke. The study highlighted that ED could be an indicator of early atherosclerosis.

**Factors influencing prognosis:**  
There are many factors influencing ED some of them are the following: underlying health conditions, lifestyle factors, psychological factors, age, medication and drugs usage, hormonal imbalance, and sexual health.

**Quality of life:**  
ED can affect the quality of life in a significant way by influencing emotional well-being, social interactions, relationships, and self-confidence. ED can also lead to stress and underlying health issues.

## Current Research and Future Directions

### Recent advances and discoveries:



- 1- Weak shockwave therapy, which is a therapy that transfers sound waves to the penile tissue which leads to improving blood flow and erectile function.
- 2- Stem cell and platelet rich plasma therapy. These focus on repairing damaged tissues and improving erectile function.
- 3- Gene therapy which divides into two parts. The first one is addressing the underlying cause of ED. The second one is fixing specific genes to improve erectile function.

### Ongoing clinical trials:

In 2024, the University of Zagreb is working on a trial to investigate the combination of low intensity shockwave therapy and tadalafil for minor to moderate vasculogenic ED. Other trials conducted by the American Urological Association (AUA) and other research institutions. These trials focus on another area of study involving alternative therapies, including stem cells and platelet-rich plasma (PRP).



### Future research needs:

More research is needed to discover the link between ED and comorbid conditions like cardiovascular disease and diabetes, as managing these conditions can lead to improvements in ED symptoms. Longitudinal research is also needed for understanding the development of ED and the long-term effects of various treatments, providing a broader view of the condition and its management over time. Finally, combining psychological therapies with medical treatments can significantly improve outcomes for ED patients, particularly because psychological factors often play a crucial role in the condition.

## Case Studies

### Example

cases:

John, a 55-year-old man, had type 2 diabetes for over 15 years. Despite medical advice, his diabetes was badly controlled, leading to complications such as neuropathy and cardiovascular issues. John also had high blood pressure and hyperlipidemia, and he was a regular smoker and drinker. Year by year, he noticed a continuing decrease in his ability to achieve and maintain erections, which began to strain his relationship with his partner.

John's case is a classic example of how chronic illnesses, such as diabetes, can lead to ED. The high blood sugar levels associated with diabetes can damage blood vessels and nerves, which are crucial for achieving an erection. Additionally, John's lifestyle choices, like smoking and alcohol consumption, further worsened his condition. His treatment involved lifestyle modifications, including quitting smoking and reducing alcohol intake, alongside better

management of his diabetes and high blood pressure. John was also recommended a phosphodiesterase type 5 (PDE5) inhibitor, such as sildenafil, which helped improve his erectile function.