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Erectile Dysfunction: Causes and Diagnosis

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Abstract

Erectile dysfunction (ED) is defined as "the inability to achieve and (or) maintain an erection sufficient to satisfy sexual activity" (Impotence, NIH Consensus Development Panel on Impotence, 1993) if these disorders are observed for at least three months. The term ED was proposed by the US National Institute of Public Health instead of the old "impotence", implying too categorical perception of the problem causing disbelief in the prospect of treatment. According to WHO, after 21 years, erectile dysfunction is detected in every 10th man, and after 60 years - every third man is not able to perform sexual intercourse at all. According to the calculations of J. B. MkKinlay (2000), about 150 million men in the world suffer from ED; it is assumed that over the next 25 years this figure may double.

Keywords:* *Urology; Erectile dysfunction

1. Introduction

In a survey published in 2003, the results of a standardized questionnaire survey of about 600 men aged 40 to 70 years in four countries of the world were cited, according to which the ED rate in Brazil was 15%, in Italy 17%, in Malaysia - 22% and in Japan - 34% [1].

According to a survey of 10,000 men aged 17 to 70 years old, conducted from April 12 to May 21, 2002, only 22.2% of the men interviewed with ED seek help of the doctor, and only 36.9% of them receive treatment. Most respondents do not consider ED as a disease, linking her appearance with stress and fatigue. According to other studies, only a third of men consult a physician, and 75%-88% of men with ED receive no treatment in this regard.

Thus, in spite of the high prevalence of ED, patients' access to medical care is still rather low. Hence, ineffective (and sometimes unsafe) self-medication and further progression of the disease. Wide awareness of not only specialists directly involved in ED, but also doctors of other specialties, namely, therapists, endocrinologists, can play an important role in the primary diagnosis of ED. In addition, the methods of treatment of ED cannot be considered in isolation from the patient's

overall medical condition, that is, as an isolated urological problem, so engaging other physicians can help to better provide medical care to these patients [2].

Thus, ED is a widespread condition, and in the overwhelming majority of cases, men do not seek medical help and do not receive adequate treatment. On the other hand, the general practitioner, to whom the patient primarily comes with all his problems, often has very vague ideas about the problem of ED and possible ways of correction.

2. Erection: Physiology and Pathophysiology

Erection is an increase in the penis in the volume with a sharp increase in its elasticity, due to the expansion and filling of cavernous bodies during sexual arousal. The phenomenon of erection consists of a complex chain of neurovascular changes in the cavernous tissue, the final link in which is the relaxation of smooth muscle elements of arteries, arterioles and sinusoids [3].

At the end of the last century, new data on the physiology of erection, the causes of ED and, consequently, new opportunities for its correction were founded. According to modern ideas, with sexual stimulation, the parasympathetic nervous system is activated. The release of neurotransmitters, in particular nitric oxide, from the vascular endothelium of cavernous bodies leads to the accumulation of cyclic guanosine monophosphate (cGMP) in cavernous tissue and relaxation of smooth muscle cells of the walls of the arteries and cavernous bodies. Filling arterial blood lacuna causes compression of the veins and blocking the outflow of blood from the penis (vein-occlusive mechanism).

3. The Basic Components of An Erection

Accordingly, the development of ED may be associated with inadequate vasodilation due to cGMP deficiency, poor receptivity of the vessels to cGMP, lack of compression of the penile veins due to proliferation of connective tissue; in addition, there may be a combination of the above reasons.

Thus, an erection can be considered as a complex neurovascular phenomenon, in the origin of which a certain role is played by sexual stimulation, the release of nitric oxide and the accumulation of cGMP in cavernous tissue, relaxation and contraction of smooth muscle cells under the influence of PDE5 [4].

4. Causes of Erectile Dysfunction

ED is usually divided into psychological (psychogenic), organic and mixed. If earlier the main cause of ED was considered various psychological problems, now this opinion has changed. It is shown that ED in 80% of cases is of an organic nature and arises as a complication of various somatic diseases (NIH Consensus Conference on Impotence) [3]. There is an inverse relationship between the incidence of ED and the level of education, physical activity, and alcohol consumption.

Age in itself certainly has an effect on the usefulness and duration of erection in men. In the elderly, blood flow velocity, testosterone level, nervous system sensitivity and the elasticity of the vascular walls decrease, this accordingly affects the

erection. However, such "natural" changes rarely lead to ED; and people who do not suffer from chronic diseases of internal organs are fully capable of living a full sexual life even in age of 80. In the vast majority of men, the main cause of erectile dysfunction, as a rule, is just a somatic disease [5].

Almost in all population studies on ED, the relationship of its occurrence with arterial hypertension (AH), diabetes mellitus (diabetes) and atherosclerosis has been revealed. ED is six times more likely to occur with diabetes and three times with AH. Moreover, according to some authors, the detection of ED may indicate that the patient has one of these diseases in a latent preclinical form. Out of 154 men who applied for ED, 44% were diagnosed with AH and 23% had diabetes.

When atherosclerosis, the walls of blood vessels lose their elasticity, their lumen narrows, there is a discrepancy between the oxygen demand for the body and the possibility of its delivery. At the same time, significant importance is attached to risk factors, such as smoking, dyslipidemia, diabetes. As it showed, thirds of patients with ED smoke, and the frequency of detection of their hypercholesterolemia is two times higher than in patients without erectile dysfunction. Atherosclerotic changes in the penile blood circulation in approximately 40% of cases cause the development of ED in men over the age of 50 years. Often different manifestations of atherosclerosis, for example, IHD and ED, develop in parallel, as the risk factors for endothelial dysfunction of coronary and penile blood vessels are the same. Therefore, it is no accident that cardiovascular diseases are significantly more frequent in patients with AH and ED than in patients with AH without disorders of sexual function. Among 174 men examined for ED, dyslipidemia was detected in 37%, uncontrolled hypertension in 17%, angina in 6%. It is assumed that ED can serve as a marker of cardiovascular diseases, and in terms of its severity it can be judged on the progression of ischemic heart disease. With a significant reduction in penile blood flow, according to ultrasound Doppler ultrasound, some authors even recommend carrying out ECG loading tests before starting ED treatment [6].

In a number of studies, it has been shown that ED is more common in the presence of arterial hypertension than in the general population. Thus, obtained as a result of a questionnaire of 512 patients aged 30 to 86 years (mean age 63.4 years), ED occurs in 46.5% of patients with arterial hypertension, 84.8% among 476 patients aged 34 to 75 years (on average 62.2 years) were sexually active and 68.3% had ED of different severity (7.7% moderate, 15.4% - pronounced and 45.2% - severe), which significantly exceeds the population level. The frequency of ED among patients with AH is 46%.

Back in 1982, Jachuck [7] noted the connection of sexual dysfunction with a deterioration in the quality of life in patients with hypertension, who received treatment with antihypertensive drugs, mainly diuretics, β-adrenoblockers. Approximately 78% of patients who have significantly deteriorated quality of life (according to their wives), there was a decrease or lack of sexual interest. Studies in aggregate over 30 years have shown that between 2.4% and 58% of men with hypertension experience one or more symptoms of sexual dysfunction of varying severity during treatment with antihypertensive drugs [8].

Especially often the occurrence of ED is associated with the use of thiazide diuretics and β-adrenoblockers. Thus, obtained from a multicenter, randomized, placebo-controlled TAIM trial, erectile problems were identified in 11% of patients who received beta-blocker (atenolol) for six months and 28% of patients receiving a thiazide diuretic (chlorthalidone). Meta-analysis has been conducted and evaluated the safety of the use of β-adrenoblockers in AH and IHD. The results of 15 studies (more than 35,000 patients) were included in the meta-analysis. It is shown that the use of drugs of this group is associated

with a small but statistically significant risk of sexual dysfunction (one additional case for every 199 patients treated with β-blockers during the year). β-adrenoblockers of the first generation more often cause ED than modern drugs, and their effect on the onset of ED does not depend on the degree of lipophilicity [9].

ED associated with AH or with its treatment can reduce the quality of life of such patients and affect their adherence to therapy. For example, a five-year study by the Medical Research Council (MRC), involving 17,354 patients with AH, showed that sexual dysfunction is a common cause of patients' refusal to take antihypertensive drugs. In this study, premature discontinuation of treatment for ED was significantly more frequent in patients taking a thiazide diuretic ($p < 0.001$) or a β-adenoblocker ($p < 0.001$), compared with placebo (12.6%, 6%, 3% and 1.3% per 1,000 person-years, respectively). Up to 70% of patients with AH who have had side effects do not follow the antihypertensive medication regimen and 40%-60% stop treatment more often than patients whose quality of life has not changed.

That is why practitioners need to remember the possibility of a variety of side effects in the genital area against the background of antihypertensive therapy and conduct discussions with patients on this topic. In many cases, changing the regimen can help the patient overcome negative changes in the sexual sphere, observed in some types of treatment. In addition, it is advisable to choose not only highly effective in terms of reducing blood pressure, but also not affecting the quality of life of the patient, the tactics of antihypertensive therapy [10].

Not all classes of antihypertensive drugs are characterized by the same risk of developing sexual disorders. In particular, recent studies indicate that angiotensin II antagonists (AAII) can even improve erectile function in men with AH. The beneficial effect of AAII on sexual function may be related to their ability to block the receptors of angiotensin II, which, as shown in the function of the experimental model of the penis, is able to stop spontaneous erection with exogenous application [11].

Calcium antagonists also appear to at least not worsen male sexual function. In any case, in which the tolerability of long-acting nifedipine (20 mg twice daily) was studied, four weeks after the initiation of therapy, the prevalence of ED declined both in the group of patients who had previously been treated with β-blockers and diuretics, and in a group of patients who had not previously received treatment.

With diabetes, ED develops three times more often and 10-15 years earlier than in a healthy population. Its frequency, according to most studies, occurs in 50%-75% of men with diabetes. In a study that was attended by 1460 patients with type 2 diabetes observed in 114 clinics. At examination, ED was detected in 34% of patients, periodic disorders of sexual function - in 24%, and only 42% had no problems in sexual life. In a study of 1010 men suffering from diabetes observed for almost three years, ED was detectable in 68 cases per 1000 patients per year. The frequency of ED development in men with diabetes increases with age and depends on the duration of the disease. If ED is found in 9%-15% of cases in patients under the age of 30, in more than 55% of cases between the ages of 30 and 60, up to 95% of DM patients suffer from ED over age 70. Apparently, precisely because of differences in age, ED occurs more often with DM of the second type than with DM of the first type. The main causes of organic ED in diabetes are diabetic polyneuropathy, macro- and microangiopathy. It was

shown that ED in men with diabetes correlates, in addition to age, with the level of glycosylated hemoglobin (HbA1c), the presence of peripheral and autonomic neuropathy, retinopathy.

A certain role may also be played by changes in the hormonal level - it is noted that in 32%-35% of men with ED there is a decrease in the level of testosterone. This can be explained by hypogonadism, obesity and other metabolic disorders.

In chronic renal failure, more than 50% of patients complain of a violation of sexual function. Conducted study of nocturnal erections in these individuals showed that ED is most often of an organic nature and that dialysis improves sexual function, but does not normalize it. The kidney transplant is more effective under condition of its normal functioning. In the study among 68 patients with chronic renal failure who received peritoneal dialysis, 63% had no sexual contact, 19% had a frequency of less than twice a month and only 18% had sexual intercourse more than twice a month. As shown by psychological testing, in patients who did not have sexual intercourse, the level of anxiety was higher, and the quality of life was lower than in patients with safe sexual activity.

In chronic obstructive pulmonary disease, as our own studies have shown, ED is detected in 12 of 20 men with chronic obstructive bronchitis and bronchial asthma. The literature mentions cases of ED in patients with obesity, duodenal ulcer, especially associated with Helicobacteriosis, steatohepatitis, urinary infection, etc., but these studies are currently scarce [12]. In men with depression, the probability of developing ED varies from 25% with mild depression to almost 90% in severe forms. ED can be triggered by a strong stress, such as the tragic death of loved ones. More often, however, there is a psychogenic variant associated with a man's unbelief in his own sexual fullness, the so-called situational ED. It is caused by self-doubt, fear of failure, a "shameful" failure, because of which a man does not dare to enter into an intimate relationship at all. Psychological testing revealed that men prone to overt or covert outbursts of anger suffer more moderate or even full ED more often than others. It should be taken into account that the presence of risk factors for organic ED does not exclude the possibility of the development of psychological ED [13].

Thus, ED is 80% organic and appears as a complication of somatic diseases - AH, atherosclerosis, diabetes, CPN, etc. In the development of ED, various mechanisms can participate: neurogenic, vascular, effects of drugs. In this case, the inverse relationship between the frequency of occurrence of ED and the level of education, physical activity, and alcohol consumption is important.

5. Diagnosis Of Erectile Dysfunction

Diagnosis of ED is based on anamnesis, physical examination, instrumental, and laboratory research. The collection of information facilitates the use of adapted questionnaires for patients with ED. The use of these questionnaires allows not only to smooth out the feeling of embarrassment in a conversation with a shy patient, but also to save the doctor's time. In clinical trials, the most common use of men is the Brief Sexual Function Inventory (BMSFI), the Sexual Encounter Profile (SEP), the Global Assessment Question (GAQ) [14].

Routine laboratory examination includes the determination of testosterone and blood glucose levels; by indications determine the level of blood lipids, prolactin, PSA. The importance of determining the level of hormones in the blood in men with ED is

evidenced by a number of studies. Among 1022 men with ED, 4% of those under the age of 50 years and 9% older than 50 years had a stably low concentration of testosterone in the blood serum; many of them were helped by testosterone treatment. In another study, of 422 men with ED, hormonal disorders were detected in 29% of cases, including hypogonadism in 19%, hyperprolactinaemia in 4%, hypo- or hyperthyroidism in 6% [15].

Further examination is indicated for persons with primary ED to exclude its organic character; Young men with a perineal trauma or pelvic organs in the anamnesis (in connection with the possible need for surgical treatment); at the request of the patient or his partner; when conducting medical examination.

The next screening study can be monitoring of night spontaneous erections. It was found that in healthy men during the night in the fast sleep phase there are four or six episodes of erections, lasting 10-15 min. The total duration of spontaneous erections is 1.5 h or 20% of the time of sleep. In men with ED, there is a decrease in the quality and quantity of spontaneous erections during night sleep. This fact allowed using monitoring for differential diagnostics of organic and psychogenic forms of sexual disorders. A recorded erection episode with a stiffness of 60% lasting more than 10 min indicates functional erectile dysfunction. It is believed that monitoring of nocturnal spontaneous erections allows quantitative and qualitative assessment of male erectile function better than any other method.

Ultrasonic dopplerography (UZDG) of the arteries of the penis allows to evaluate microcirculation, and its carrying out in B-mode - to reveal structural changes in cavernous fibrosis and Peyronie's disease. However, the results of the duplex method are much more complete than with the separate use of regimes B and D. In addition, the quality of the research largely depends on the technical perfection of the apparatus on which it is performed. UZDG of the arteries of the penis is more informative if it is performed at rest and erection with subsequent comparison of results, which is achieved using functional tests - visual stimulation (erotic film) or drug (Viagra) test [16].

The main quantitative indicators are the maximum (peak) systolic velocity (PSV) and the final diastolic velocity (EDV). On the basis of absolute indices, according to standard formulas, relative - the index of resistance (RI) and the pulsation index (PI) are calculated. Normally, a PSV of 30 cm/s -35 cm/s is taken as the norm, and the lower limit of the norm is usually considered to be 25 cm/s. After pharmacological stimulation, the greatest value for a given patient is achieved usually within 5-10 mins. Acceleration should then exceed 400 cm/s^2, and the acceleration time should be less than 0.1 s.

One of the diagnostic methods is the Viagra test in combination with visual stimulation against the background of erectile monitoring and evaluation of penile hemodynamics by ultrasound scanning. The advantages of the test include non-invasiveness and absence of a threat of priapism; to the disadvantages - the need for visual stimulation, which does not allow the standardization of the method - different men need different stimuli. The new PDE5 inhibitor tadalafil has the same mechanism of action and is characterized by a fairly rapid onset of the effect. Already in the 16th minute, 32% of men achieve an erection with sexual stimulation. Another feature of the drug - the duration of the effect is 36 h - gives the patient the opportunity not only to verify the effectiveness of the drug during the diagnostic procedure, but also to perform sexual intercourse in natural conditions for him [17].

The test with intracavernous introduction of vasoactive drugs (usually - alprostadil, analogue of prostaglandin E) allows to reveal vasculogenic ED. With normal arterial and veno-occlusive hemodynamics, a pronounced erection occurs after 10 min after injection, which lasts for 30 min or more.

According to the testimony, other studies are performed, namely:

- cavernosometry (determination of the volumetric velocity of the physiological solution injected into the cavernous bodies necessary for the onset of erection) is the main test directly assessing the degree of disturbance of the elasticity of the sinusoidal system and its closing ability;
- cavernosography (shows venous vessels, through which the discharge of blood from the cavernous bodies predominantly takes place);
- radioisotope phalloscintigraphy (allows to evaluate qualitative and quantitative indicators of regional hemodynamics in the cavernous bodies of the penis);
- neurophysiological studies, in particular, the definition of bulbocavernous reflex in patients with diabetes, with damage to the spinal cord.

Thus, modern diagnostic methods using a sufficient amount of research can determine the cause of erectile disorders with high accuracy. This is primarily necessary to implement a pathogenetic approach to the choice of treatment [18].

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