Epidemiology and etiologies of male sexual dysfunction

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INTRODUCTION

Male sexual dysfunction, a problem that becomes more common with increasing age, includes erectile dysfunction (ED), diminished libido, and ejaculatory disorders. Significant progress has been made in the understanding of erectile physiology and the causes of male sexual dysfunction. In addition, a number of effective therapies have been developed for the different categories of male sexual dysfunction.

This topic will provide a review of erectile physiology, and the epidemiology and causes of sexual dysfunction in men. The evaluation and treatment of men with sexual dysfunction are discussed separately. (See "Evaluation of male sexual dysfunction" and "Treatment of male sexual dysfunction".)

ERECTILE PHYSIOLOGY

Normal male sexual function requires interactions among vascular, neurologic, hormonal, and psychological systems. The initial obligatory event required for male sexual activity, the acquisition and maintenance of penile erection, is primarily a vascular phenomenon, triggered by neurologic signals and facilitated only in the presence of an appropriate hormonal milieu and psychological mindset.

Neural influences — Psychogenic erections are triggered by neural impulses originating in the paraventricular nucleus (PVN) and medial preoptic area (MPOA) of the hypothalamus [1]. Sexual images may originate in response to erotic visual or auditory stimuli or be generated via

fantasy. The centrally perceived sensual input is relayed by neural signals to a spinal cord neural center located at T-11 to L-2 (the thoracolumbar erection center). From there, neural impulses flow to the pelvic vascular bed, redirecting blood into the corpora cavernosa.

Reflex erections are created by tactile stimulus to the penis or genital area, which activates a reflex arc with sacral roots originating at S-2 to S-4 (the sacral erection center). Psychogenic erections are more common during man's early sexually active years, whereas reflex erectile activity dominates during his mature years.

Nonsexual, nocturnal erections, occurring three to four times nightly, start in early adolescence. Nocturnal erectile activity occurs during REM sleep and may go unnoticed by sleeping men, although most men will be aware of an erection when they arise in the morning. These early morning erections often fade after urination, creating the incorrect impression that they are a reflex response to a full bladder.

Nocturnal erections occur only during rapid eye movement (REM) sleep (figure 1) [2]. Men with chronic sleep disorders, such as obstructive sleep apnea, have diminished REM sleep and typically have fewer nocturnal or early morning erections. Nocturnal erections persist throughout life, although, for as yet unexplained reasons, nocturnal erectile activity is not as tightly coupled to REM sleep in older men [3].

Role of blood flow and nitric oxide — Normal erections require blood to flow from the hypogastric arterial system into specialized erectile chambers, the paired corpora cavernosa flanking the penile urethra, and the corpus spongiosum at the glans penis. As blood flow accelerates, the pressure within the intracavernosal spaces increases dramatically, preventing penile venous outflow from emissary veins. This combination of increased intracavernosal blood flow and reduced venous outflow allows a man to acquire and maintain a firm erection. High levels of intrapenile nitric oxide act as a local neurotransmitter to facilitate the relaxation of intracavernosal trabeculae, thereby maximizing blood flow and penile engorgement [4]. Nitric oxide is formed under the influence of the enzyme nitric oxide synthase, which, in conjunction with nicotinamide adenine dinucleotide phosphate (NADPH) and oxygen, transforms the substrate amino acid arginine to citrulline and nitric oxide.

The absolute prerequisites for penile erectile activity are an adequate arterial inflow to provide a constant source of intracavernosal oxygen and sufficient nitric oxide synthase to generate nitric oxide. Nitric oxide acts by promoting the generation of cyclic guanosine monophosphate (GMP).

Detumescence (loss of erection) occurs when nitric oxide-induced vasodilation disappears because of metabolism of cyclic GMP, which is primarily mediated by intracavernosal type 5

cyclic GMP phosphodiesterase [4]. Detumescence also is, in part, regulated by norepinephrine pathways.

The role of nitric oxide may have important therapeutic implications for patients with erectile dysfunction (ED). Low intracavernosal nitric oxide synthase levels are 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. On the other hand, sildenafil, as well as vardenafil, tadalafil, and avanafil, are all phosphodiesterase (PDE-5) inhibitors. All four PDE-5 inhibitors enhance intracavernosal cyclic GMP levels to improve the erectile response to sexual stimulation in many men with ED. (See "Treatment of male sexual dysfunction".)

Interference with oxygen delivery or nitric oxide synthesis can 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 [5], and diabetes mellitus, which is associated with suboptimal nitric oxide synthase activity [6].

Hormonal influences — Testosterone plays an integral role in normal male sexual function. The onset of adolescent nocturnal erections coincides with the pulsatile release of hypothalamic gonadotropin-releasing hormone (GnRH), which stimulates pulsatile luteinizing hormone (LH) secretion, and stimulation of Leydig cell testosterone secretion [7].

Testosterone deficiency results in ED in men, and function returns when testosterone levels are normalized [8].

- Normal testosterone levels are important for libido [9].
- Testosterone is necessary for maintenance of intrapenile nitric oxide synthase levels [10]. The role of testosterone therapy in the management of ED is discussed separately. (See "Treatment of male sexual dysfunction", section on 'Role of testosterone'.)

EPIDEMIOLOGY

Sexual activity and age — Sexual activity is affected by age, health status, and sex. In one population-based survey, men were more likely than women to be sexually active and report a good-quality sex life [11]. Sex differences increased with age and were most noticeable in the 75- to 85-year-old group; 39 percent of men versus 17 percent of women were sexually active. In other reports, the prevalence of sexual activity in the last year declined with age, with women

less likely than men at all ages to report being sexually active [12,13]. Older men reported a higher incidence of sexual concerns with aging.

Although men may remain sexually active, there are a number of age-associated changes in sexual function in men including delay in erection, diminished intensity and duration of orgasm, and decreased force of seminal emission [14]. Sexual function and dysfunction in women is reviewed separately. (See "Overview of sexual dysfunction in females: Epidemiology, risk factors, and evaluation".)

Prevalence — The strong association between sexual function, aging, and male health was first shown in the early 1990s. A widely cited survey, the Massachusetts Male Aging Study (MMAS), reported that male sexual dysfunction, presenting as ED, diminished libido, or abnormal ejaculation, first emerges as a common problem for men in their early 40s and increases with advancing age [15]. The annual incidence rate increased with each decade (12, 30, and 46 cases per 1000 man-years for men ages 40 to 49, 50 to 59, and 60 to 69 years old, respectively). The risk of erectile dysfunction (ED) was higher for men with lower education, diabetes, heart disease, and hypertension.

At age 40 years, 40 percent of men in the MMAS acknowledged some degree of impaired sexual function and 10 percent recognized a decline in sexual function with each succeeding decade (figure 2) [16]. A nine-year longitudinal follow-up study of this same cohort confirmed the age-associated declines in most domains of sexual function: sexual intercourse, erection frequency, sexual desire, satisfaction with sex, and orgasm [17].

The high prevalence of sexual problems has been confirmed by a number of other studies [18-21]. In a report from the National Health and Social Life Survey, 31 percent of a cohort of younger men ages 18 to 59 years reported sexual dysfunction.

In other reports, findings included:

- Erection and ejaculation difficulties are associated with urinary and prostate symptoms, regardless of age [20].
- Sexual satisfaction in men is associated with relationship status and physical health [21,22].

Types of male sexual dysfunction

Erectile dysfunction (ED) — ED is defined as the consistent or recurrent inability to acquire or sustain an erection of sufficient rigidity and duration for sexual intercourse. The frequency of

sexual activity decreases with age, and sexual problems become more common with aging [14,23].

In men, the most common type of sexual dysfunction is ED. A number of cross-sectional and longitudinal studies suggest a high prevalence of ED in the general population [16-19,24-28]. ED was reported by 18 percent of men ages 50 to 59 years in one study [18] and by 37 percent of those age 70 to 75 years in a multinational study of over 27,000 men ages 20 to 75 [29]. (See 'Erectile dysfunction' below.)

Decreased libido — The prevalence of reduced libido is estimated to be 5 to 15 percent in men [18]. It increases with age, and it frequently accompanies other sexual and voiding disorders [20]. Men with ED may experience loss of libido as a secondary consequence of ED. This usually is ascertained from a detailed sexual history, including the chronology of the disorder. However, most patients who complain of ED do not complain of reduced libido or sexual desire. (See 'Low libido' below.)

Ejaculatory disorders — Ejaculatory disorders are a heterogeneous group of disorders that include premature, delayed, and retrograde ejaculation and anorgasmia. Premature ejaculation (PE) is also referred to as rapid or early ejaculation. PE occurs in approximately 4 percent of the male population, although up to 30 percent of men in community surveys complain of ejaculating too rapidly [30,31]. Loss of ejaculation is often age-related and may be associated with other sexual dysfunction in the male, particularly ED [32-34]. Ejaculatory disorders are discussed in more detail separately. (See 'Ejaculatory disorders' below.)

ERECTILE DYSFUNCTION

Risk factors and predictors — There are a number of risk factors for and predictors of erectile dysfunction (ED) (table 1). In addition to age, the best predictors of ED are cardiovascular disease (CVD), diabetes mellitus, hypertension, obesity, dyslipidemia, hypogonadism, smoking, depression, and medication use (table 1) [16-18,22,35-41].

Cardiovascular disease — CVD and its risk factors, including diabetes mellitus, increase the risk for later ED [35,42,43]; on the other hand, ED appears to be an early warning sign of future cardiovascular events [44]. ED and CVD share many risk factors, and their pathophysiology is mediated through endothelial dysfunction (table 2) [22,26,36,37,45].

In an umbrella review of five meta-analyses and two systematic reviews addressing the association of ED with CVD found higher risks of CVD (relative risk [RR] 1.45, 95% CI 1.36-1.54),

coronary heart disease (RR 1.50, 95% CI 1.37-1.64), myocardial infarction (RR 1.55, 95% CI 1.33-1.80), and stroke (RR 1.36, 95% CI 1.26-1.46) in patients with ED than in other patients [46].

The evaluation for possible CVD in men with ED is reviewed separately. (See "Evaluation of male sexual dysfunction", section on 'Erectile dysfunction and cardiovascular disease'.)

Diabetes mellitus — Patients with diabetes mellitus are at increased risk for both CVD and ED. In addition, observational studies suggest that the presence of ED is a predictor of cardiovascular events in men with diabetes [47,48], as it is for men without diabetes. The frequency of ED in men with diabetes increases with age. In one report from a large community diabetes clinic, the prevalence increased from 6 percent in men aged 20 to 24 years to 52 percent in those aged 55 to 59 years [49]. In addition to increasing age, the main factors associated with ED were peripheral or autonomic neuropathy, retinopathy, long duration of diabetes, hypogonadism, and poor glycemic management.

In a similar study, the severity of ED was positively correlated with diabetes duration, poor glycemic management, diuretic therapy, and presence of microvascular or cardiovascular disease [50]. Not surprisingly, men with diabetes who develop ED experience a significant decline in quality-of-life measures as well as an increase in depressive symptoms [51]. Conversely, depression is a well-recognized contributor to ED. Unfortunately, ED may go undetected as many clinicians do not inquire about sexual health. As an example, a large epidemiologic survey reported that the majority of men with diabetes and ED had never been asked by their clinicians about their sexual function and, therefore, did not receive treatment [52].

Chronic kidney disease — Chronic kidney disease (CKD) is also a risk factor for CVD and for ED. Sexual dysfunction (decreased libido and ED) are common in men with CKD [53,54]. These problems may improve but rarely normalize with the institution of maintenance dialysis, commonly resulting in a decreased quality of life [55]. Kidney transplantation is the most likely intervention to restore normal sexual function [56-58]. Factors that may contribute to ED include peripheral neuropathy, autonomic dysfunction, peripheral vascular disease, hypogonadism, depression, hyperprolactinemia, and drugs such as beta-blockers and antidepressants. (See "Chronic kidney disease and coronary heart disease" and "Kidney transplantation in adults: Sexual and reproductive health after kidney transplantation".)

Other cardiovascular risk factors — In addition to diabetes mellitus, a number of cardiovascular risk factors are associated with higher rates of ED, including hypertension, obesity, smoking, dyslipidemia, and obstructive sleep apnea (table 1) [16-18,35-40]. In a prospective cohort study of 570 men followed for approximately 25 years, the presence of risk

factors for coronary heart disease (smoking, obesity, dyslipidemia) in midlife (mean age 46 years) were associated with incident ED (mean age 72 years at the time of follow-up) [35].

- Obstructive sleep apnea is a risk factor for CVD as well as for ED (independent of other confounders such as obesity and smoking); treatment with continuous positive airway pressure (CPAP) may improve or preserve sexual function [59,60]. (See "Treatment of male sexual dysfunction", section on 'Lifestyle changes'.)

- Lifestyle factors – In one study, exercise was associated with a lower risk of ED, and the lowest prevalence was noted in men without chronic medical problems who engaged in healthy behaviors [19]. In obese men with ED, weight loss and increased physical activity are associated with an improvement in erectile function in approximately one-third of patients. (See "Treatment of male sexual dysfunction", section on 'Lifestyle changes'.)

Psychosocial factors — Depression, stress, and relationship issues are commonly associated with ED (table 1) [61]. In a meta-analysis of 49 studies, the presence of ED was associated with a higher risk of depression (odds ratio [OR] 1.39, 95% CI 1.35-1.42; 48 studies), and the presence of depression was associated with a greater risk of ED (OR 2.92, 95% CI 2.37-3.60; only 6 studies). The American Urological Association recommends that all men who present with ED undergo an evaluation for potential psychosocial factors (including depression and anxiety) [61]. (See "Evaluation of male sexual dysfunction".)

ED that develops suddenly is typically due to performance anxiety. This problem may be caused by performance anxiety, issues with the current sexual partner, or some other emotional problem; psychological counseling is the preferred therapy in this setting.

Neurologic — Neurologic causes of ED include stroke, spinal cord or back injury, multiple sclerosis, or dementia. In addition, pelvic trauma (such as from radical prostatectomy or pelvic radiation) or priapism may cause ED (table 1) (see "Evaluation of male sexual dysfunction"). Only radical prostatectomy or other overt genital tract trauma causes a sudden loss of male sexual function. In comparison, men suffering from ED of any other cause describe erectile function that failed sporadically at first, then more consistently.

Drugs — Eight of the 12 most commonly prescribed medications list ED as a side effect [62,63], and it is estimated that 25 percent of cases of ED are due to medications. Examples of medications that disrupt normal male sexual function include (table 1):

- **Antidepressants** – Most antidepressants, in particular, selective serotonin reuptake inhibitors (SSRIs), are associated with ED. (See "Sexual dysfunction caused by selective serotonin reuptake inhibitors (SSRIs): Management".)

- **Antihypertensives** – Some antihypertensives have been associated with ED [64]. The effect of antihypertensive drugs on ED was assessed in the Treatment of Mild Hypertension Study (TOMHS) [65]. In this trial, patients with mild hypertension were randomly assigned to therapy with lifestyle modifications plus placebo or one of five antihypertensive drugs, each from a different class: acebutolol, amlodipine, chlorthalidone, enalapril, and doxazosin. The incidence of ED at two years was higher with chlorthalidone (a thiazide diuretic) than placebo (17.1 versus 8.1 percent); no other drug was different from placebo. Antihypertensive drugs that are the least likely to be associated with ED are angiotensin-receptor blockers, angiotensin-converting enzyme inhibitors, and calcium channel blockers [66].

  It had been thought that beta blockers are an important cause of ED, but a systematic review of randomized, controlled trials found only a small increased risk of sexual dysfunction with beta blocker therapy (5 per 1000 patients treated). However, if a patient develops ED after initiating a beta blocker and is bothered by his condition, the authors would recommend trying an alternative antihypertensive [67] (see "Major side effects of beta blockers"). Alpha-adrenergic blockers, such as doxazosin, have been observed to improve sexual function and libido [68].

- **Anti-androgens** – Androgen deprivation therapy (ADT), which lowers serum testosterone levels to castrate levels, is an integral component of the systemic treatment of castration-sensitive metastatic prostate cancer and of some patients with high-risk localized prostate cancer. (See "Initial systemic therapy for advanced, recurrent, and metastatic noncastrate (castration-sensitive) prostate cancer", section on 'Benefits and methods for androgen deprivation therapy'.)

- **Other** – Other drugs that have been associated with ED include spironolactone, sympathetic blockers (clonidine, guanethidine, and methyldopa), ketoconazole, and cimetidine (but not other histamine 2 receptor antagonists).

  Although some recreational drugs, such as cocaine and heroin, can initially stimulate libido and sexual arousal, they ultimately exert a negative impact on the ability to acquire and sustain erectile function [69].

Endocrine disorders — Testosterone deficiency also affects peripheral and central mechanisms that are responsible for penile erections. The effects of testosterone therapy on libido are more consistent than on erectile function [70,71]. (See "Treatment of male sexual dysfunction", section on 'Role of testosterone'.)

Hypogonadal men are still capable of exhibiting some erectile activity during nocturnal penile tumescence studies [72,73]. However, the penile swelling in this setting usually is not of sufficient rigidity to permit vaginal penetration. This defect is corrected after normalization of testosterone levels, probably due to restoration of intrapenile nitric oxide synthase levels.

The testosterone level associated with ED is uncertain. In a study of 1162 men, serum testosterone levels <225 ng/dL (7.80 nmol/L) were associated with an increased frequency of sexual dysfunction [74]. In the Testosterone Trials, no threshold serum testosterone level was observed for ED [75].

Other disruptions in hormone secretion, including hyperprolactinemia, hyperthyroidism, and hypothyroidism are commonly associated with ED (table 1) [76]. Restoration of the normal hormonal state usually results in the return of erectile function [77].

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/neuropathy) may play a role in the ED so commonly seen in men with diabetes [78]. However, the role of testosterone in this context is complicated by the overlapping and interactive effects over time of age, obesity, depression, cardiovascular disease, and other common comorbidities in men [79].

Other

- **Sleep disorders** – Restless leg syndrome (RLS) was identified as an independent risk factor for ED in a prospective study of over 10,000 men (mean age 63 years) followed for six years [80]. The impact of RLS treatment on ED has not yet been investigated. Men who present with sleep disorders should also be questioned about the presence of ED.

- **Other diseases** associated with ED include systemic sclerosis (scleroderma), Peyronie's disease, and prostate cancer treatment (eg, brachytherapy, prostatectomy) (table 1). (See "Overview of the treatment and prognosis of systemic sclerosis (scleroderma) in adults" and "Peyronie's disease: Diagnosis and medical management" and "Overview of sexual dysfunction in male cancer survivors".)

- **Bicycling** – There is a possible (but controversial) association of ED with bicycling. Anything that places prolonged pressure on the pudendal and cavernosal nerves or compromises blood flow to the cavernosal artery can result in penile numbness and impotence. The penile numbness in cyclists has been attributed to the pressure on the perineal nerves, whereas the ED is thought to be due to a decrease in oxygen pressure in the pudendal

arteries (which may be more of a problem with certain bicycle seats) [81]. This is thought to be a potential problem predominantly for serious cyclists.

- **Pornography** – Given widespread availability of pornography via the internet, concerns have been raised about its potential association with ED and other sexual disorders. In fact, results of epidemiologic studies of the association are mixed and generally inconclusive. While some studies have shown a positive association between pornography use and increased ED risk in younger men [82], other studies have failed to replicate this effect [83,84]. Of note, one study reported that while pornography usage per se was not associated with an increased incidence of sexual dysfunction in younger men, self-perception of internet pornography addiction was associated with adverse sexual outcomes, including erectile dysfunction [85].

LOW LIBIDO

Libido declines with testosterone deficiency, stress, relationship issues, depression, and systemic illness.

Additional causes of low libido include:

- Some of the medications associated with low libido include selective serotonin reuptake inhibitors (SSRIs), anti-androgens, 5-alpha reductase inhibitors, and opioid analgesics
- Alcoholism
- Fatigue
- Recreational drugs, such as marijuana, cocaine, and lysergic acid diethylamide (LSD)
- Other sexual dysfunction

In addition to hypogonadism, other endocrine abnormalities associated with low libido in men include hyperprolactinemia, hypercortisolemia, low estradiol, and both hypo- and hyperthyroidism. One study demonstrated that estrogen was a key component of sexual function in men [86]. Hyperprolactinemia induces hypogonadism by interfering with the secretion of gonadotropin-releasing hormone (GnRH) from the hypothalamus [87]. The evaluation of low libido is reviewed separately. (See "Evaluation of male sexual dysfunction".)

EJACULATORY DISORDERS

Ejaculatory disorders are a heterogeneous group of disorders that include premature, delayed, and retrograde ejaculation and anorgasmia. The evaluation and management of ejaculatory

disorders are discussed separately (see "Evaluation of male sexual dysfunction" and "Treatment of male sexual dysfunction"). Painful orgasm may also be included in this category; this topic is reviewed in detail separately. (See "Peyronie's disease: Diagnosis and medical management".)

Premature ejaculation — Premature ejaculation (PE) is also referred to as rapid or early ejaculation and is now defined as a male sexual dysfunction characterized by:

- Ejaculation that always or nearly always occurs prior to or within approximately one minute of vaginal penetration, either present from the first sexual experience or following a new bothersome change in ejaculatory latency;
- The inability to delay ejaculation on all or nearly all vaginal penetrations; **and**
- Negative personal consequences, such as distress, bother, frustration, and/or the avoidance of sexual intimacy [88]

Using this stringent definition, PE occurs in approximately 4 percent of the male population, although up to 30 percent of men in community surveys report PE [21,30,31,89-91]. Few of these men typically seek treatment for their condition.

Approximately 30 percent of men with PE have concurrent ED, which typically results in early ejaculation without full erection [30,31,92]. A wide range of severity is seen, with patients ejaculating on or prior to penetration in the most severe cases. Patients sometimes present for infertility concerns [30,31].

Other ejaculatory disorders

- Other disorders of ejaculatory function include a spectrum of disorders in men ranging from retrograde ejaculation to delayed ejaculation to a complete inability to ejaculate (anejaculation), and anorgasmia [32,33].
- Multiple etiologic factors have been identified, including organic and psychogenic factors. Any medical disease, drug, or surgical procedure that interferes with either central (including spinal or supraspinal) control of ejaculation or the autonomic innervation to the seminal tract, including the sympathetic innervation to the seminal vesicles, the prostatic urethra, and bladder neck, or sensory innervation to the anatomical structures involved in the ejaculation process, can result in delayed ejaculation, anejaculation, and anorgasmia [93].
- Factors thought to be associated with ejaculatory dysfunction include:

- Low serum testosterone concentrations, but the failure of testosterone to correct the abnormality suggests that the relationship is not causal [94,95]. (See "Treatment of male sexual dysfunction", section on 'Other'.)

- Lower urinary tract symptoms (LUTS) in older men may be associated with ejaculatory disorders [20,96]. In one multinational survey of 12,815 men ages 50 to 80 years, patient age and severity of LUTS (independent of diabetes mellitus, hypertension, heart disease, and dyslipidemia) were associated with sexual problems (including ejaculatory disorders) [20].

- Commonly used drugs such as certain alpha blockers (eg, tamsulosin and silodosin), 5-alpha-reductase inhibitors (eg, finasteride and dutasteride), and antidepressants, particularly selective serotonin reuptake inhibitors (SSRIs; eg, paroxetine), have been associated with loss of orgasm or ejaculation [96]. (See "Sexual dysfunction caused by selective serotonin reuptake inhibitors (SSRIs): Management".)

- Surgery for benign prostatic hyperplasia commonly results in retrograde ejaculation, whereas radical prostatectomy or cystoprostatectomy result in anejaculation [97]. (See "Overview of sexual dysfunction in male cancer survivors".)

- Patients with longstanding diabetes mellitus can also develop retrograde ejaculation due to failure of the bladder neck to close during ejaculation.

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Male sexual dysfunction".)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading

level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topics (see "Patient education: Sex problems in men (The Basics)" and "Patient education: Sex as you get older (The Basics)")
- Beyond the Basics topics (see "Patient education: Sexual problems in men (Beyond the Basics)")

SUMMARY

- **Epidemiology** – Sexual dysfunction is common in men and increases with age (figure 2). There are several kinds of male sexual dysfunction: decreased libido, erectile dysfunction (ED), and ejaculatory disorders. Ejaculatory disorders include premature ejaculation (PE), delayed ejaculation, and anejaculation. Painful orgasm is also included in this category and is reviewed separately. (See "Peyronie's disease: Diagnosis and medical management".)
  - Reduced libido is estimated to affect approximately 5 to 15 percent of men [18]. It increases with age, and it frequently accompanies other sexual disorders. (See 'Epidemiology' above.)
  - ED was reported by 18 percent of men ages 50 to 59 years in one study [18] and by 37 percent of those age 70 to 75 years in a second report [29]. (See 'Erectile dysfunction (ED)' above.)
  - PE is considered to be the most common of the ejaculatory disorders, with an estimated overall prevalence of 20 to 30 percent [98]. (See 'Ejaculatory disorders' above.)
- **Erectile dysfunction** – There are a number of risk factors for and predictors of ED (table 1). In addition to age, the best predictors of ED are cardiovascular disease (CVD), diabetes mellitus, hypertension, obesity, dyslipidemia, smoking, and medication use (table 1). ED and CVD share many risk factors, and their pathophysiology is mediated through endothelial dysfunction. CVD and its risk factors increase the risk for later ED; on

the other hand, ED may be an early warning sign of future cardiovascular events. (See 'Cardiovascular disease' above.)

- **Low libido** has been associated with low testosterone, stress, relationship issues, depression, and systemic illness. Other causes of low libido include (see 'Low libido' above):

  - Medications (selective serotonin reuptake inhibitors [SSRIs], anti-androgens, 5-alpha reductase inhibitors, opioid analgesics)
  - Alcoholism
  - Depression
  - Recreational drugs
  - Other sexual dysfunction (fear of humiliation)

  Low libido and ED are sometimes due to the same problem, such as depression and hypogonadism. In addition, the development of ED is associated with an increased risk of depression.

- **Ejaculatory disorders** – Ejaculatory disorders are a heterogeneous group of disorders that include premature, delayed, and retrograde ejaculation and anorgasmia. PE is also referred to as rapid or early ejaculation. (See 'Ejaculatory disorders' above.)

  - Other disorders of ejaculatory function include a spectrum of disorders in men ranging from retrograde ejaculation to delayed ejaculation to a complete inability to ejaculate (anejaculation), and anorgasmia.

  - Any medical disease, drug, or surgical procedure that interferes with either central (including spinal or supraspinal) control of ejaculation or the autonomic innervation to the seminal tract, including the sympathetic innervation to the seminal vesicles, the prostatic urethra, and bladder neck, or sensory innervation to the anatomical structures involved in the ejaculation process, can result in delayed ejaculation, anejaculation, and anorgasmia.

  - Additional factors thought to be associated with ejaculatory dysfunction include low testosterone concentrations, lower urinary tract symptoms (LUTS), and commonly used drugs such as certain alpha blockers (eg, tamsulosin and silodosin) and antidepressants, particularly SSRIs (eg, paroxetine), that have been associated with loss of orgasm or ejaculation. (See 'Ejaculatory disorders' above.)

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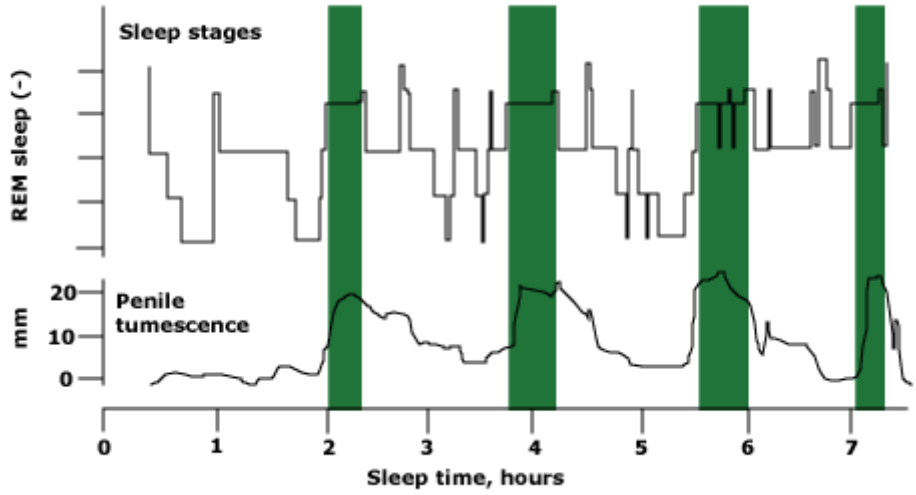
Topic 6840 Version 31.0

GRAPHICS

Association of nocturnal erections with REM sleep



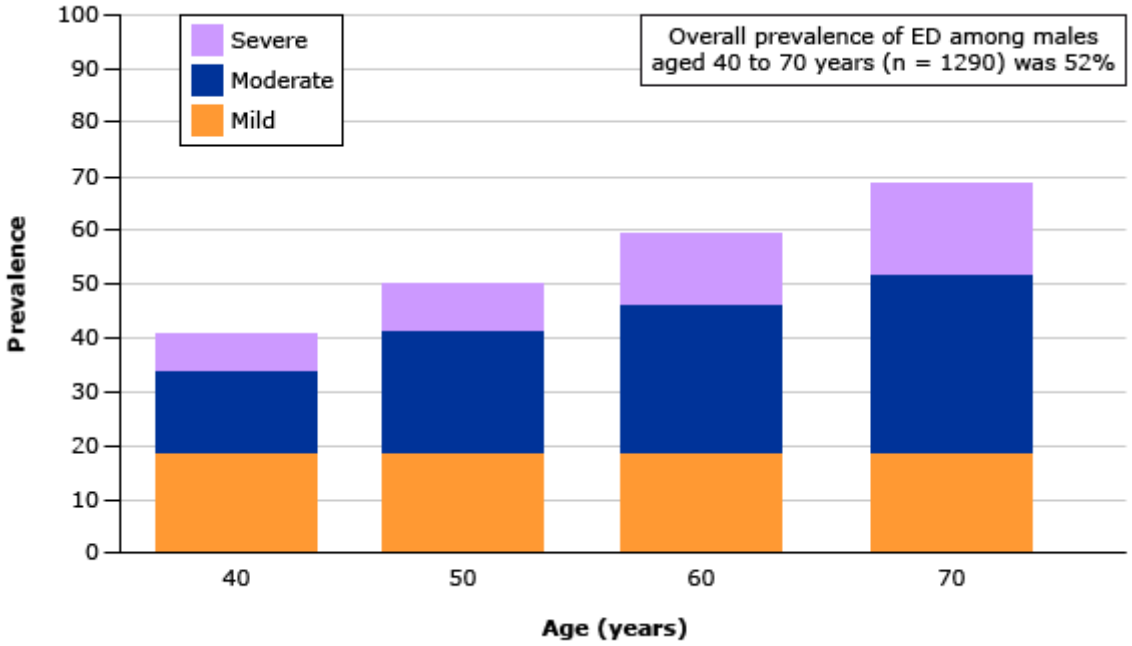
Penile tumescence during the different stages of sleep. Nocturnal erections occurred during periods of REM sleep (columns).

REM: rapid eye movement.

Data from: Karacan I, Williams RL, Thornby JI, Salis PJ. Sleep-related penile tumescence as a function of age. Am J Psychiatry 1975; 132:932.

Graphic 56491 Version 2.0

Prevalence and severity of ED in the Massachusetts Male Aging Study (MMAS)



The overall prevalence of mild, moderate, and severe ED was 17.2, 25.2, and 9.6%, respectively.

ED: erectile dysfunction.

Original figure modified for this publication. Feldman HA, Goldstein I, Hatzichristou DG, et al. Impotence and its medical and psychosocial correlates: results of the Massachusetts Male Aging Study. J Urol 1994; 151:54. Illustration used with the permission of Elsevier Inc. All rights reserved.

Graphic 107343 Version 2.0

Etiologies of erectile dysfunction[1-3]

Vascular	Cardiovascular disease, hypertension, diabetes mellitus, hyperlipidemia, smoking, major surgery (radical prostatectomy) or radiotherapy (pelvis or retroperitoneum)
Neurologic	Spinal cord and brain injuries, Parkinson disease, Alzheimer disease, multiple sclerosis, stroke, major surgery (radical prostatectomy) or radiotherapy of the prostate
Local penile (cavernous) factors	Peyronie's disease, cavernous fibrosis, penile fracture
Hormonal	Hypogonadism, hyperprolactinemia, hyper- and hypothyroidism, hyper- and hypocortisolism
Drug induced	Antihypertensives, antidepressants, antipsychotics, antiandrogens, recreational drugs, alcohol
Psychogenic	Performance-related anxiety, traumatic past experiences, relationship problems, anxiety, depression, stress

ED is classified as organic (ie, vasculogenic, neurogenic, local penile [cavernous] factors, hormonal, drug-induced), psychogenic, or mixed psychogenic and organic. ED usually develops from a mix of psychogenic and organic factors[1,2]. Psychological factors are involved in the development of ED and include performance-related issues (eg, performance anxiety), traumatic past experiences, relationship problems, anxiety, depression, and stress[1-3]. Taking a comprehensive medical history may reveal one of the many common disorders associated with ED[1].

ED: erectile dysfunction.

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Graphic 97650 Version 4.0

Cardiovascular risk stratification in males with erectile dysfunction[1,2]

Low-risk category	Intermediate-risk category	High-risk category
Asymptomatic, <3 risk factors for CAD (excluding sex)	≥3 risk factors for CAD (excluding sex)	High-risk arrhythmias
	Mild or moderate, stable angina	Unstable or refractory angina
	Previous (>6 to 8 week) or recent (2 to 6 week) MI	Recent (<2 week) MI
LVD/CHF (NYHA class I or II)	LVD/CHF (NYHA class III)	LVD/CHF (NYHA class IV)
Post-successful coronary revascularization	Noncardiac sequelae of atherosclerotic disease (eg, stroke, peripheral vascular disease)	Hypertrophic obstructive and other cardiomyopathies
Controlled hypertension		Uncontrolled hypertension
Mild valvular disease		Moderate-to-severe valvular disease

The Princeton Consensus (Expert Panel) Conference is dedicated to optimizing sexual function and preserving cardiovascular health[1]. Patients with ED can be stratified into three cardiovascular risk categories as summarized in this table, which can be used as the basis for a treatment algorithm for initiating or resuming sexual activity[1,2].

CAD: coronary artery disease; MI: myocardial infarction; LVD: left ventricular dysfunction; CHF: congestive heart failure; NYHA: New York Heart Association; ED: erectile dysfunction.

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Graphic 97651 Version 5.0

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Conflict of interest policy

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