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Epidemiology of Erectile Dysfunction

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INTRODUCTION

Erectile dysfunction (ED) is a pervasive problem among men worldwide. The National Institutes of Health Consensus Conference defined ED as the “consistent inability to attain or maintain a penile erection, or both, sufficient for adequate sexual relations” (1).

This definition better encompasses the full spectrum of activity that is affected by ED, as opposed to definitions considering only vaginal penetration. Furthermore, it was believed that the term ED was less pejorative than the older term *impotence*. The negative impact of ED on a man is tremendous, including diminishment in self-esteem and sense of well-being, and negative affects on relationships with not only partners, but also acquaintances (2).

Recent data from a longitudinal analysis of the Massachusetts Male Aging Study (MMAS) estimated that up to 600,000 new cases of ED occur annually in the United States (3). This is in addition to a prevalence estimated to be 10 to 20 million American men (4,5). The National Health and Social Life Survey (NHSLs) found that 31% of men have sexual dysfunc-

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tion, which they defined broadly in seven different categories, of which ED was one (6). Furthermore, this study reinforced the notion that sexual function strongly affects a man's global sense of well-being and that sexual dysfunction should be a significant public health concern.

The most recent data suggest that ED increases markedly by decade. A telephone survey of 820 men was conducted who were classified as having ED and admitted that they were sometimes or never able to get or keep an erection satisfactory for sexual intercourse (7). Based on these criteria, the prevalence of ED increases from 8% during the 40s to 19% in the 50s to 39% in men older than 60 yr of age.

This study found ED to be associated with diabetes but not ischemic heart disease, elevated cholesterol, or hypertension.

In the past, studies of male sexual health were poorly constructed and anecdotal, and assessed poorly defined patient populations. Recently, with the publication of data from the MMAS, the NHSLs, the Multinational Survey of the Aging Male in seven countries, and a number of international surveys, robust data now exist defining the epidemiology of ED (3,6,8–14).

EPIDEMIOLOGY OF ED

Kinsey

No chapter pertaining to the epidemiology of male sexual dysfunction would be complete without reference to the classic and ground-breaking work by Kinsey et al. They reported the results of their pioneering study of male sexual function and dysfunction in 1948. Their work clearly documented an increase in ED with age (15). They surveyed 12,000 men and found that the prevalence of ED increased dramatically with age. Men younger than 19 yr of age had a less than 1% risk of ED, compared with less than 3% for men younger than 45 yr of age, 7% in men less than 55 yr of age, and 25% in men age 75 or older. Reanalysis of these data suggested that the original report had underestimated the true prevalence of ED. This reanalysis suggested that as many as 42% of a subset of 5000 of the men reported some erectile difficulty (16).

Massachusetts Male Aging Study

The MMAS was a community-based survey of 1290 men 40 to 70 yr of age from the Boston area that specifically examined, among other items, the prevalence and effects of aging on ED in a cohort of healthy men (8). This study also examined the impact of medical comorbidities on ED. Care was taken to exclude men with significant medical problems and to represent minority populations appropriately in the sample. The survey was composed of 23 questions, nine specifically inquiring about erectile function.

The study found that 52% of the population complained of some degree of ED. The breakdown was mild ED in 17% of men, moderate ED in 25% of men, and severe ED in 10% of men overall. Forty percent of men in their 40s experienced ED, whereas 67% of men experienced ED by 75 yr of age. Complete ED was found in 5% of men by 40 yr of age and in 25% of men by 75 yr of age. When extrapolated to the male population in general, this analysis estimated that 30 million American men and 100 million men worldwide have ED.

In addition to epidemiology, this study also examined risk factors associated with ED. Medical conditions that increased the risk of ED after controlling for age in this study included cardiovascular disease, hypertension, diabetes, depression, anger disorders, and arthritis. Medications associated with ED included vasodilators, oral hypoglycemic agents, and antihypertensives. Several factors were found to be protective against ED. These included high-serum high-density lipoprotein levels, elevated serum dehydroepiandrosterone levels, and dominant personality.

A reanalysis of 847 men 40 to 69 yr old was published more recently (3). The reanalysis followed those men who had no measurable ED symptoms at the beginning of the study. The patients were followed for almost 9 yr, and a 13-question sexual function survey was completed by each of the men. The risk of new-onset ED was 26 cases per 1000 men per year, with the risk increasing by age, presence of heart disease or hypertension, and educational level. Further analysis revealed that lifestyle factors also played a role in the occurrence of ED. Obesity was strongly correlated, and physical activity inversely correlated, with ED (17). The most active men had the lowest risk of developing ED; however, obesity at baseline was still associated with an elevated risk of ED regardless of future weight loss. Interestingly, tobacco and alcohol use were not found to be related to ED risk in this study. Based on these data, Johannes et al. estimate that there are 600,000 cases of ED in the United States annually (3).

National Health and Social Life Survey

The NHSLS was a study that used a 90-min interview to examine the risk of having experienced sexual dysfunction within the preceding 12 mo (6). The interview was conducted by an interviewer of identical gender to the interviewee and was carried out on a population that was representative of the general American population. Seven questions in each of seven areas (libido, experience of ED, orgasm, performance anxiety, premature orgasm, pain during intercourse, and lack of enjoyment during intercourse) were asked during this interview. A large cohort of both men (1410) and women (1749) participated in this study, with an age range of 18 to 59 yr.

In men, the incidence of sexual dysfunction was as follows: premature ejaculation, 21%; ED, 5%; and decreased sexual desire, 5%. Seventy percent of men were not affected by any sexual dysfunction in this survey. Risk factors associated with ED in this study were emotional problems, stress, worsening health status, lower urinary tract symptoms, sexual trauma, and deteriorating economic situation.

Furthermore, ED was found to be associated with lower levels of physical and emotional satisfaction, as well as diminished global happiness. For men, premature ejaculation was not found to be associated with negative physical or emotional satisfaction, nor with low levels of happiness. Men with ED, however, were 4.4, 2.4, and 2.5 times more likely to experience low physical satisfaction level, low emotional satisfaction level, or low general happiness level, respectively, than men without ED. A low level of desire was associated with a 3.1- and a 2.6-fold increased risk of having low levels of physical satisfaction and general happiness, respectively. Women are also significantly affected by sexual dysfunction. Low levels of desire, arousal disorder, and sexual pain were all significantly associated with low physical and emotional satisfaction levels, as well as a low general happiness level, to even larger degrees than men in many cases. Clearly, ED specifically, and sexual dysfunction broadly, are associated with reductions in the quality of life.

International Data

A variety of international surveys have explored the prevalence of ED. Surveys of men in Australia, England, Germany, the Netherlands, and Spain have estimated the prevalence of ED to be 11 to 34% in men aged 16 to 80 yr (10–14).

The Kolner Erhebungsbogen der Erektile (KEED) study of men in Cologne, Germany, used a validated questionnaire and found a dramatic increase in ED with age (10). The investigators collected 4489 questionnaires from respondents with a mean age of 51.8 yr, 66.1% of whom were either married or involved in a long-term relationship. The overall prevalence of ED was 19.2% in all men. They found a 2.3% prevalence of ED in 30 to 39-yr-old men, 9.5% in men in their 40s, 15.7% in men in their 50s, 34.4% in men in their 60s, and 53.4% in men in their 70s. As described in previous studies, age is the strongest risk factor for ED.

Supporting the findings of the MMAS study, the investigators found that hypertension, diabetes, and previous pelvic surgery were strong risk factors for ED. The reported odds ratios for concurrently having ED if one of these was a comorbid condition were found to be 1:58 with hypertension, 3:95 with diabetes, and 6:03 with previous pelvic surgery, indicating strong, significant relationships. This study also found a 72.2% prevalence

of lower urinary tract symptoms (LUTS) in men with ED, compared with 37.7% in men without LUTS. The odds ratio of having ED if one had LUTS was 2:1 compared with men without LUTS. This finding suggests a strong relationship between the two conditions.

Alcohol and tobacco use were not associated with ED.

A major limitation of the KEED/Cologne study was that the International Index of Erectile Function (IIEF) was not used as the measure of ED. This would have allowed easier comparison to many other studies of ED that more often use the IIEF. Furthermore, the 56% response rate, although respectable, still left open the possibility that nonresponders differed in some significant way from responders, thus biasing the study. Overall, given the strong agreement with other large survey trials, the data support a link between ED and age, hypertension, diabetes, previous pelvic surgery, and LUTS.

Community-based populations in Brazil, Italy, Japan, and Malaysia were randomly sampled to assess ED based on their “ability to maintain an erection satisfactory for sexual intercourse” (18). A total of 600 men who were 40–70 yr old from each country were included in the analysis. Moderate to complete ED was found in 34% of Japanese men, 22% of Malaysian men, 17% of Italian men, and 15% of Brazilian men. Prevalence rates of moderate to severe ED increased with age as follows: 9%, 40 to 44 yr of age; 12%, 45 to 49 yr of age; 18%, 50 to 54 yr of age; 29%, 55 to 59 yr of age; 38%, 60 to 64 yr of age; and 54%, 65 to 70 yr of age. The risk of ED increased by 10% per year.

Factors that increased the risk of ED were diabetes, heart disease, LUTS, tobacco use, and depression (18). Higher educational level, high physical activity, and moderate alcohol consumption were associated with a lower risk of ED.

SUMMARY OF EPIDEMIOLOGICAL DATA

ED is a prevalent problem in men worldwide. The condition increases with age and is found in more than 50% of men older than the age of 65–70 yr in most studies. A variety of medical conditions are associated with an increased risk of ED, including diabetes, vascular disease, and depression, as well as elevated cholesterol levels, arthritis, hypertension, and heart disease. Diseases that impair penile blood flow or innervation will most likely have pathophysiological links to ED, whereas diseases that lower a man’s sense of well-being may impair libido and mood, leading to secondary reduction in erectile function.

Most surveys have found that physical activity, higher educational background, and moderate alcohol consumption are associated with a lower risk of ED. Whether these factors modify the pathophysiological develop-

ment of ED, exist in men with a better global mood, or are simply associated with a lower risk of comorbid conditions remains unclear.

RISK FACTORS FOR ED

Vascular Disease

Well-known causes of ED include arterial insufficiency and veno-occlusive dysfunction (venous leak). These conditions are related to generalized vascular disease in many patients with ED. Patients with a previous history of a myocardial infarction, hypertension, or peripheral vascular disease all carry an increased risk of developing ED. In fact, more than half of patients who have either experienced a myocardial infarction (MI) or undergone cardiac bypass surgery experience ED (19,20). A decrease in penile-brachial index (PBI) has also been shown to be associated with future risk of MI. Patients with an abnormal PBI were found to have a 12% incidence of MI, vs only a 1.5% incidence in those with normal PBI in one study (21). Most men (80%) with peripheral vascular disease suffer from ED, and 10% of men with untreated hypertension also have ED (22,23).

A recently advanced hypothesis to explain this relationship centers on endothelial dysfunction (24). Briefly, endothelial dysfunction may impair smooth muscle relaxation by interfering with nitric oxide synthesis or release (25). Generalized vascular disease, specifically cardiovascular disease, is associated with ED, and the link is thought to be via endothelial dysfunction in both cases. In fact, many studies now suggest that ED may serve as a marker for occult cardiovascular disease (26).

Diabetes is another systemic disorder that impairs vasculature, as well as neurological function. One-third to three-quarters of men with diabetes will ultimately experience ED (23). By the time many diabetics are diagnosed, they already have ED. It is estimated that in up to 14% of men diagnosed with diabetes, ED predates the diagnosis of their metabolic condition. Men with insulin-dependent diabetes have a higher incidence of ED than those with noninsulin-dependent diabetes (27). Fifty percent of diabetics develop ED within 10 yr of diagnosis (28,29). The effects of diabetes on erectile function occur over a relatively rapid period of time compared with the end-organ effects of diabetes, such as retinopathy and nephropathy. The risk of ED in diabetic men is increased significantly by the presence of other vascular risk factors, including tobacco use, hypercholesterolemia, and hypertension (30).

The metabolic syndrome is a newly described syndrome encompassing systemic dysfunction characterized by glucose intolerance, hypertension, hyperlipidemia, and central obesity (31). This syndrome is now recog-

nized as a risk factor for ED (32). The previously mentioned data linking endothelial dysfunction to ED is likely the link between the metabolic syndrome and ED, because all of the mentioned pathological processes are associated with endothelial damage and dysfunction (33).

LUTS

LUTS and ED are prevalent problems for the aging male. There is little question that the two conditions are linked, at least insofar as both occur in similarly aged populations. The age relationship between LUTS and ED has been demonstrated in population-based surveys across decades and cultures. These associations have also been strengthened by multivariate analyses showing independent relationships between age and LUTS and age and ED. Data from the Multinational Survey of the Aging Male in seven countries found a very strong relationship between age, LUTS severity, and ED (9). This analysis found that for every decade, the percentage of men with moderate (International Prostate Symptom Score [IPSS] 8–19) or severe (IPSS > 19) LUTS increased, and that for each IPSS grouping (IPSS 0, 1–7, 8–19, >19), the frequency of sexual activity declined with age and the prevalence of ED increased.

Blanker et al. surveyed 1600 men with the IPSS and International Continence Study sex questionnaires to investigate a relationship between age, LUTS, and ED in the same study. A multivariate logistic regression analysis of the data found that age, obesity, and urinary tract symptoms were the most important correlates of significant ED (11). A British study found that rigidity of erection and ejaculate volumes decreased with age. Nine percent of men in their 40s, 79% of men in their 70s, and 86% of men in their 80s reported decreases in rigidity of erection. Reduced ejaculation was also found to increase in prevalence with age. Men with LUTS had a significantly higher odds ratio for sexual dysfunction compared with men without urinary symptoms. Overall, a strong relationship between LUTS and ED was found, but no correlation was found between flow rate and ED (34).

Many investigators have found that LUTS adversely impacts patients' overall quality of life. Impaired quality of life is associated with ED, thus there is the potential for a link. Many studies have documented a very large negative impact on quality of life among men with LUTS. In the Olmsted County study, LUTS was associated with significantly worse physical and mental health overall (35). Men with large prostates were twice as likely to be bothered by their symptoms and also twice as likely to think their symptoms interfered with activities of daily life (36). In another study among men with LUTS, 20% reported that urinary dysfunction impaired at least one daily activity most or all of the time (37).

Important basic science work is examining the impact of bladder obstruction on the corpora. Experimental models were created in animals to test the effect of bladder outlet obstruction on cavernosal smooth muscle. These studies have found alterations in the nitric oxide pathway, changes in the histological structure of erectile tissue, and an altered response of corporal smooth muscle to contractile agents (38–40). Thus, whether the link is a result of age, quality of life, or some other physiological derangement, LUTS is definitely associated with ED.

Endocrine Disorders

As previously mentioned, diabetes is the most prevalent endocrinopathy that causes ED. A variety of other hormones also affect erectile function, however. Testosterone influences libido and contributes to nocturnal tumescence; however, the ultimate role of androgens in ED has not been well defined (41–45). Recent studies demonstrated that correcting the hypogonadal state by giving supplemental testosterone improves response to sildenafil in men with ED and low testosterone level (46). Testosterone clearly plays a role in the level of libido, but the exact role in ED is still debated (45). Hyperprolactinemia, hypothyroidism, hyperthyroidism, and adrenal disorders may either lower serum testosterone level or alter the testosterone:estradiol ratio, thus affecting sexual function. These disorders are the cause of less than 5% of cases of organic ED (47).

Psychological Disorders

Psychological factors definitely play a significant role in erectile function. How a poor quality of life links LUTS to ED was already discussed. Four decades ago, most sexual medicine practitioners believed that ED was a result of psychological disorders in most men. The majority of men with ED are now thought to have organic causes, but many psychiatric and psychological conditions have an impact on erectile function. Furthermore, many men with multiple vascular risk factors and documented organic causes of ED have a secondary sexual psychological component contributing to ED. It is now appreciated that many men have mixed ED (48). The link between depression and ED is well established. Many studies have found an increased incidence of ED in men with depression. Interestingly, men with depressive symptoms and ED note improvements in their depression with successful treatment of the ED (48–51).

Poor overall mood may negatively affect erectile function (52). It is believed that a depressed mood contributes to overall low quality of life, which has been shown to impair erectile function in men. Poor marital relationships also negatively affect erectile function (53).

Shabsigh et al. investigated the incidence of depressive symptoms in men who had ED (51). They examined 120 men with either ED, benign prostatic hypertrophy (BPH), or both. They found that 54% of men with ED and 56% of men with ED and BPH but only 21% of men with BPH alone experienced depression. Men with ED had a 2.6-fold increased risk of depressive symptoms as compared with men with BPH alone, which was statistically significant even after controlling for age, marital status, and comorbidities. Furthermore, patients with depression had a significantly lower libido rating than those without depression. This study also found that depression as a comorbid condition of ED complicated treatment. Although 100% of men with ED who were given treatment remained on the treatment plan, only 38.9% of men with depression and ED remained on an ED therapy plan during the study ($p < 0.0002$). Not only are ED and depression related, but having the two seems to complicate treatment for ED.

Recent data from Nigeria also supports a link between depression and ED (54). The IIEF and the patient health questionnaire were completed by 829 Nigerian men in active military service. They examined the relationship between age, depression, alcohol abuse, and panic disorder to erectile dysfunction.

The mean age of the men was 36.7 yr, and 75% were married. ED was found in 39.6% of all men. Thirty-six percent of men younger than 30 yr of age reported ED, as did 31% of men in their 30s, 46% of men in their 40s, 58% of men in their 50s, and 100% of the two men surveyed who were older than 60. Of men with ED, 10.3% were found to experience depressive symptoms. The degree of depression was not associated with ED. Multivariate analysis found that age and depression were predictors of ED in this study, but not alcohol abuse or panic disorder.

The evidence linking depression directly to ED is somewhat weak. Several additional recent studies have found no link between the two conditions. Araujo et al. examined longitudinal data from the MMAS to study the incidence of ED among men with depression (55). They examined longitudinal data gathered over 8.8 yr from 776 respondents to the MMAS to look for the development of ED among men with several psychological problems. The presence of depressive symptoms (analyzed with the Center for Epidemiologic Studies Depression scale [CES-D]) at study entry was not significantly predictive of developing ED during the study ($p = 0.12$). Among men with baseline depression, 13.2% developed ED, compared with 21.3% of men overall (not significant). One limitation of this study was that depressive symptoms and not a diagnosis of major depressive disorder were used to identify men with depression. Intuitively, more severe depression may be related to ED, or, as the authors point out, the effect of depression may be temporary and may lessen with time.

Other recent studies found no association between current depressive symptoms and moderate to severe ED (56). They received questionnaires from 199 men who completed basic health inventories, the CES-D, and an abbreviated version of the IIEF. Moderate or complete ED was found in 36.4% of men, depression was found in 12.1%, and ED with depression was found in 5.1%. Multivariate analysis found no significant relationship between ED and depression; furthermore, the absolute score on the CES-D questionnaire was not related to the presence of moderate or complete ED. This well-done study gives strong support to the finding that depression and ED are not related. However, the relatively low response rate of the subjects to the survey (59.6%) somewhat weakens the data.

Another recent survey found that men with ED often suffer great distress, but only a few fulfill the clinical criteria for a diagnosis of depression. Only 18.6% of a cohort of depressed men who presented for evaluation reported some degree of sexual dysfunction (57). Some of this variation is explained by differences in the definition of depression. Depressed mood and poor quality of life are very common among men with ED, but clinical depression is not as common. Therefore, until a consistent definition of depression is used and a large sample is followed, any relationship between ED and depression must be regarded with skepticism.

Medications

A plethora of medications have been associated with ED. Studies suggest that as many as one-quarter of patients seen in general medical practices have ED as a result of a medication that they take (58). Many patients who take antihypertensives complain of ED. Although the cause of the ED may be directly related to the medications, some studies suggest that the pathophysiological effect of hypertension on the vasculature may contribute to worsening erectile function. In fact, up to 40% of patients who require antihypertensive medications develop ED (59–61). Antihypertensives in such broad classes as β -blockers, calcium channel blockers, diuretics, and ganglionic blockers have all been implicated in ED. Whether the cause is a diminished blood pressure resulting in insufficient inflow to maintain an erection, direct ganglionic blocking action, or an antiandrogen effect (spironolactone), these medications exert a wide range of effects on the erectile mechanism.

The impact of antihypertensive medication use on ED was carefully evaluated in the Treatment of Mild Hypertension Study (62). This double-blind, randomized trial compared placebo with acebutolol, amlodipine, chlorthalidone, doxazosin, or enalapril in terms of the incidence of sexual dysfunction during the study. Age, baseline hypertension, and previous use of antihypertensive medications were associated with ED. At baseline,

12.2% of men reported ED. Although this finding is lower than expected, men with diabetes, cardiovascular disease, and excess alcohol intake were excluded, so this cohort was probably healthier than the average hypertensive group. The incidence of ED among treatment groups and placebo groups was 6 to 17% at 24 mo and 11 to 18% at 48 mo. Only men taking chlorthalidone had a significantly higher risk of developing ED at 24 mo (15.7%) compared with those taking placebo (4.9%, $p < 0.01$). Men taking doxazosin had a lower rate (2.8%), but this was not significant. At 48 mo, no group differed significantly from the placebo group in the incidence of ED. The authors suggested that new-onset ED developing during treatment for hypertension should not be attributed to medication use generally. Sexual dysfunction may be more related to blood pressure control than medication use *per se*.

These findings agree with those of the MMAS, which found ED to be related to hypertension but also found a relationship between antihypertensive-drug use and ED (8). This study may suggest a relationship between medication use as a marker of hypertension rather than between medication use and ED specifically.

The authors find the data from the randomized, placebo-controlled trial to be convincing and caution anyone from attributing ED to antihypertensive medication use until other risk factors for ED are explored fully.

Antidepressants constitute another class of widely used drugs that are believed to impair erectile function (63). Once again, whether this effect is a direct pharmacological one or is related to the underlying disease process for which the patient is using a psychotropic agent remains unclear. The newer selective serotonin reuptake inhibitors have also been associated with ED that may or may not respond to proerectile medications (64). Overall, the treatment of depression may improve ED symptoms. Antidepressants may exacerbate the condition. ED that persists after a bout of depression must be thoroughly investigated to rule out other causes before pharmacological alterations are begun. Other psychiatric medications, including neuroleptics used to treat schizophrenia, are often associated with ED. Both older (clomipramine) and newer (olanzapine) antipsychotics have been implicated in the development of ED (65,66).

Drugs with endocrine effects may contribute to ED. The most widely used are the luteinizing hormone—releasing hormone agonists for the treatment of advanced and metastatic prostate cancer, which are well known to cause ED. Other drugs, including cimetidine, estrogens, and spironolactone, all have been demonstrated to antagonize androgen production or action and may contribute to ED (67–69). Agents that act on cell membranes may impair tonic excitation or relaxation of smooth muscles, which may lead to ED. For example, digoxin potentiates smooth muscle

contraction via its effect on the sodium–potassium–ATPase pump in smooth muscle cells, eventually leading to increased intracellular levels of calcium (70).

Before any medication is changed or discontinued because of a complaint of ED, a thorough search for other causes must be initiated (59). Many of the conditions for which the abovementioned medications are used also exert progressive negative effects on erectile function.

Systemic Diseases

The literature cites an association between a variety of chronic diseases and ED. Chronic renal insufficiency is often associated with ED. Forty to 80% of men with chronic renal insufficiency or end-stage renal disease have some degree of associated ED (71,72). The causes of ED in renal failure include hypogonadism, hyperprolactinemia, diabetic neuropathy, and vasculopathy, or some combination of these factors (73). ED in patients with renal failure may be improved by transplantation but may also require adjunctive treatment (74–76).

Neurological disorders are also commonly associated with ED. Cerebrovascular accidents, multiple sclerosis, and neurodegenerative disorders, including Alzheimer's disease and Parkinson's disease, are all associated with ED (77,78). Following a cerebrovascular accident, up to 85% of men experience ED, and almost 75% of men with multiple sclerosis experience ED (79,80).

Patients with human immunodeficiency virus and acquired immunodeficiency syndrome may acquire an autonomic neuropathy leading to ED (81).

Other conditions that have been associated with ED include chronic obstructive pulmonary disease (82), systemic sclerosis (83), sleep apnea syndrome (84), and liver disease (85).

Trauma

Penile or perineal trauma, usually blunt, and pelvic fracture are associated with ED. Up to 50% of men who experience straddle injuries or prostatomembranous urethral disruption in pelvic fractures develop ED (86). Common penile artery injury is thought to account for the pathophysiology of this type of ED (87).

Treatment of posterior strictures (often resulting from trauma) can also lead to the development of ED (88). The cause of ED in this case is thought to be the interruption of the autonomic nerve fibers that run in close proximity to the posterior urethra, either with initial injury or while dissecting the urethra during repair. The IIEF was examined as a tool to evaluate men after pelvic trauma to identify those with ED (89). Of 77 consecutive men

identified, 46 returned the survey; of these men, 29.7% were found to have some degree of ED. Men with pubic diastasis had a significantly increased risk of decreased erection firmness and a significantly lower degree of erection confidence than did men without diastasis. These authors suggested that cavernosal nerve injury at the time of diastasis may account for the increased risk of ED in these men.

A recent study from Israel identified 25 consecutive patients with posterior urethral strictures secondary to pelvic fracture (90). Eighteen (72%) experienced ED before attempted urethral reconstruction. Thirteen of the men were diagnosed with neurogenic ED—as evidenced by normal vascular response on duplex ultrasound with intracavernous injection—and five were diagnosed with arteriogenic ED—as demonstrated by an abnormal arterial response to intracavernous injection. Cases of secondary arteriogenic ED can be treated by penile revascularization (91).

Posterior urethroplasty for stricture is thought to be associated with a small but significant risk of ED. The data for anterior strictures are much better, with a recent large series reporting only one new onset of ED among 168 consecutive patients who underwent anterior urethroplasty (92).

Surgical trauma is also commonly associated with ED. Radical prostatectomy is probably the most commonly performed urological procedure associated with ED. The cause of ED in this case is likely neurological impairment but may also be associated with vascular disease of the corporal bodies (93,94). Pelvic exenteration for either rectal cancer or bladder cancer is also associated with very high rates of resulting ED (95). The sacral nerve roots that supply the autonomic nervous supply to the cavernous nerve, which mediates erection, may be disrupted during radical pelvic surgery.

Trauma can also occur as a result of vigorous physical activity. Extreme bicycling may be associated with ED (96). Compared with age-matched runners, members of a cycling club had a threefold increased risk of developing ED. A Scandinavian review of 160 cyclists found that of men participating in a 540-km race, 22% reported pudendal or cavernous nerve symptoms after the race, with 33 complaining of penile numbness and 21 complaining of impotence (97).

Mountain biking may be associated with even higher rates of ED. The pathophysiology of this effect is thought to be compression of the common penile arteries against the ischiopubic ramus as a result of an unpadded bicycle seat. Recent studies have measured the transcutaneous oxygen pressure in healthy volunteers without ED (98). They found significant decreases in penile oxygen pressure (which correlates well with arterial and tissue pO_2) regardless of the amount of seat padding. Only wider seats were associated with less of a decrease in pO_2 . Although an association has been shown, causation is far from established.

SUMMARY

ED is a highly prevalent worldwide problem. This condition increases with age and is more commonly seen with comorbid medical conditions, including cardiovascular disease, diabetes, and neuropsychiatric disorders. Other associated conditions include trauma, pelvic surgery, and cycling. Recent evidence is accumulating to suggest a robust link between LUTS and ED, which until now was thought to be coincidental. Clearly, ED is a cause of substantial morbidity throughout the world and deserves special consideration during the diagnostic evaluation of any patient, male or female, because ED can have a profound impact on overall mood.

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