



Erectile Dysfunction in Adolescents and Young Adults

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Abstract

Purpose of Review The goal of this paper is to provide a summary of the recent research, evaluation, work-up, and treatment recommendations regarding erectile dysfunction in adolescents and young adults to better equip pediatric urologists to manage patients with this condition.

Recent Findings The latest research regarding erectile dysfunction in this population includes organic and psychogenic etiologies, correlations between the COVID-19 pandemic, and online pornography consumption.

Summary In our large pediatric urology practice, we found an 31x increase of adolescent males presenting with erectile dysfunction since 2014. The majority of cases are attributed to a psychogenic etiology such as anxiety or depression. It is likely that with stress from anxiety and depression, cortisol levels rise, increasing vascular resistance and leading erectile dysfunction in this population. Most patients want to be reassured of normal testosterone levels, offered cognitive behavioral therapy, and be rehabilitated with tadalafil starting at 5 mg p.o. daily until tapered.

Keywords Adolescent erectile dysfunction · Young adult erectile dysfunction · Sexual dysfunction adolescent · Sexual dysfunction young adult · Erectile dysfunction work-up · Erectile dysfunction treatment

Introduction

Within the last few years, there has been a marked increase in adolescent males presenting to pediatric urologists with complaints of erectile dysfunction (ED). Unfortunately, there is very little published data on young adults and no data on adolescents regarding the pathophysiology, contributing causes, evaluation, and treatment of ED. It has been well established that the prevalence of ED is positively correlated with age. It affects about 20% of men over the age of 40, with a prevalence that is 4 times higher for men in their 70 s compared to their 20 s [1]. ED is also more prevalent among men with comorbid conditions such cardiovascular disease, hypertension, diabetes mellitus, or neuropsychiatric conditions [2]. Unfortunately, much is unknown about ED in adolescents and young adults. Interestingly, the risk factors and medical conditions known to cause ED in the adult

population are typically absent in the adolescent population. Therefore, we cannot apply the guidelines provided for typical evaluation and treatment of ED to the younger populations, since the guidelines are tailored to an older population.

The significant increase of younger populations presenting with ED demonstrates the complexities of the condition and highlights the need for further research regarding the potential etiologies, pathophysiology, work-up, and treatment of ED in this population. A proper evaluation and treatment tailored to this younger population is crucial given its profound effects on confidence, self-esteem, and mental health [3]. In this review, we will summarize the recent literature involving adolescent and young adults with ED and provide pediatric urologists with background and guidance for the treatment of these patients.

Incidence Rates

Given the paucity of data on adolescents and young adults, there is no consensus on the actual rate of ED in these males. In our large pediatric urology practice, we found an increasing number of adolescent males presenting with ED over the last few years. Among 129 adolescent males (aged 14–21) presenting with ED over 6 years, we found our

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volume increased from 1 in 2014 to 32 in 2020, Fig. 1, with an increase during winter months (61%) compared to summer (38%) [4]. Interestingly, we found that the peak number of presentations occurred during the early months of the COVID-19 pandemic and nationwide lockdown [4].

Capogrosso et al. reported 1 out of every 4 male patients seeking medical attention for newly diagnosed ED is under the age of 40 [5]. The prevalence of ED has been reported to be 8% among men in their 20 s and 11% in men in their 30 s, with an incidence four times higher for men in their 70 s compared to their 20 s [6, 7]. The Sexual Medicine and Andrology Clinic at the University of Florida reported that 14% of men under the age of 40 complained of ED, however, there was significant increase in this younger age group the last few years [7]. All this information suggests the rapid rise of younger adults presenting with ED, emphasizing the importance of increasing awareness of this condition in this population and appropriate screening by clinicians.

Pathophysiology of Erectile Dysfunction

Normal physiology: The formation of an erection includes a complex interplay of neuropsychiatric and vascular systems. External stimulus activates neurons in the hypothalamus which travel down the parasympathetic system to the sacral plexus, signaling the cavernous nerve terminals to release nitric oxide and initiate the erectile process. Nitric oxide permits the relaxation of the intracavernosal smooth muscles, allowing blood flow into the corpora cavernosa causing compression of the emissary veins and reduced venous outflow, permitting a rigid erection [8].

Pathophysiology of ED: The American Urological Association (AUA) defines ED as the consistent or recurrent inability to attain and/or maintain penile erection sufficient for sexual satisfaction, including satisfactory sexual performance [9]. Psychogenic ED is the inability to achieve

or maintain an erection secondary to psychogenic factors. Vascular ED is the inability to form an erection secondary to vascular dysfunction, such as impaired arterial inflow, venous leak, or structural abnormalities. Neurogenic ED is a classification of disorders impairing erections by neurologic impairment, such as stroke, spinal injury, or multiple sclerosis. The neurogenic origin compromises about 15% of types of ED [10]. Peripheral neurogenic ED can be secondary to the disruption of the signals to the brain or the efferent nerves facilitating the erection, while a central neurogenic ED can occur from lack of excitation or increased inhibition [10]. Excluding neuropsychiatric factors, there are several organic etiologies that may explain ED in younger populations which disrupt central or peripheral nerve signals such as spinal injuries, multiple sclerosis, medication side effects, Charcot-Marie-tooth, epilepsy, familial amyloid polyneuropathies, and diabetes mellitus [10].

Psychogenic vs Organic Nature of Erectile Dysfunction in Young Populations

The International Society for Sexual Medicine stratifies etiologies of ED into psychogenic and organic components [11]. Psychogenic etiologies known to cause ED are depression, anxiety, loss of self-esteem, psychosocial stressors, trauma, performance anxiety, or side effects to psychiatric medications. Organic etiologies that are well known to cause ED are cardiovascular, metabolic, endocrine, or neurologic conditions.

Several studies have looked at the relationship of psychogenic causes of ED. Caskurlu et al. concluded that ED in younger men is mostly psychogenic in nature. They found 85.2% of men younger than 40 years old had psychogenic ED, compared to 40% over 40 years old, with 14.8% of younger men and 59.3% of older men having an organic cause. [12].

Calzo et al. investigated ED in a cohort of 2,660 men, aged between 18–31. Among this cohort, 11% reported mild ED and 3% reported moderate-to-severe ED. Moderate-to-severe ED was more prevalent among those who were single, used antidepressants, or had anxiety. Obesity, diabetes, hypertension, and hypercholesterolemia were not associated with ED, likely because these conditions were not present long enough to cause vascular damage. The results further suggest that ED in this population may be associated more with psychogenic factors, rather than organic etiologies [13].

Although most cases of young adults presenting with ED have been deemed neuropsychiatric in origin, recent studies have advocated for the evaluation of cardiovascular risk factors such as diabetes, obesity, hypertension, and hypercholesterolemia to rule out an organic component of ED. Yao et al. compared 122 male patients aged between 20 and 40

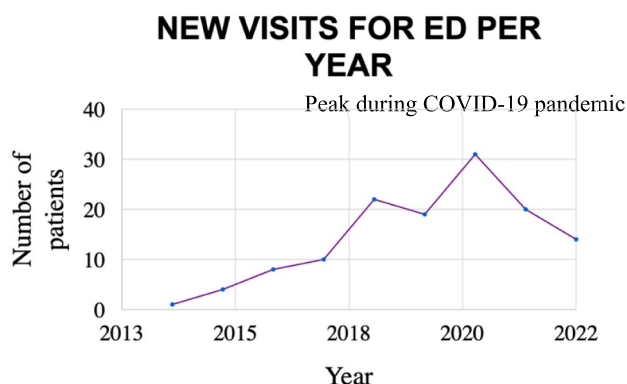


Fig. 1 Number of patients presenting to our large pediatric urology practice over the last 10 years

to 33 age-matched controls. They found that those with ED were more likely to have elevated blood pressures, C-reactive protein levels, total cholesterol, and triglyceride levels, however, all the values were within normal limits. These results suggest that although men with ED may not have clinical cardiovascular or metabolic disease, subclinical risk factors are present that predispose them to ED [14]. Besiroglu et al. has defined “metabolic syndrome” which refers to patients with elevated levels of cortisol. These elevated levels of cortisol lead to hypertension, hypercholesteremia, and diabetes. These patients also have increased sympathetic tone which increases vascular resistance and can lead to ED in this population [15].

The Association Between Anxiety and Depression in Adolescents and Young Adults with Erectile Dysfunction

Manolo et al. explored the association between depression, anxiety, and ED in a cohort of 314,761 men, aged 18–40 years old with an average age of 33. Their results revealed a greater incidence of depression and/or anxiety in young men with ED compared to men without ED at all time points studied. A 5.3% absolute increase in depression and/or anxiety diagnosis was observed in men with ED 3 years after their initial diagnosis compared to men without ED. This shows a positive association between the two conditions and indicates a temporal nature of this reciprocal relationship [16].

Pozzi et al. analyzed 307 men under the age of 40 presenting to a physician with a primary complaint of new onset ED. The aim was to evaluate risk factors associated with severity of ED by use of the International Index of Erectile Function questionnaire (IIEF-5). Interestingly, the results suggested that patients with severe ED had metabolic and cardiovascular derangements comparable to those with normal erectile function. In addition, there was no difference in recreational habits such as alcohol use or smoking between the groups. Those who reported worse erectile function scores by the IIEF frequently had symptoms of significant mood deflection and depression. These findings seem to suggest that psychogenic components were the main etiology of ED in a group of young men [17].

As anxiety and depression can lead to increased rates of ED, medications used to treat these conditions, such as serotonin reuptake inhibitors (SSRIs), can also lead to ED. SSRIs that most commonly cause ED are citalopram, escitalopram, fluoxetine, paroxetine, sertraline, vortioxetine, and fluvoxamine. It is appropriate to have an initial period of observation if one experiences ED shortly after starting an SSRI, as sexual side effects may diminish with time. If side effects persist, the dose may be lowered, patients may schedule intercourse

at times when side effects are least bothersome such as hours after taking the medication, a different antidepressant such as bupropion or mirtazapine, or they may try adding sildenafil or tadalafil to alleviate SSRI side effects [18].

Online Forum, Reddit, to Explore Erectile Dysfunction in Young Adults

An interesting study by Jiang et al. evaluated young adults complaining of ED on an internet online discussion board, called Reddit. The authors analyzed 329 posts and 1702 response posts from the Reddit forum “r/ErectileDysfunction” and applied an extraction method with principal component analysis to identify themes in the posts. Young adults often experience shame, embarrassment, and loss of masculinity regarding ED; thus, they are less likely to present to a health provider for evaluation. Instead, they are more likely to turn to easily accessible sources at hand such as the internet for health-related information or even support. The median age of users was 24 years old. The study reported regarding ED [19]:

- Driven by psychogenic factors, representing the most common self-reported etiology – 48% of users
- Performance anxiety—41% posts
- Feelings of depression—38% of posts
- Did not report an etiology—35% of users
- Excessive pornography usage and masturbation—22% users
- Self-reported anatomic etiologies – 15% of users
- Self-reported endocrine etiologies – 12% of users
- Self-reported etiology secondary to medication side effects – 5% of users
- Self-harm or suicidality was associated with ED -2% of posts
- Regarding self-reported treatment modalities:
 - Consultation with a healthcare provider – 27% of users
 - PDE-5 inhibitor – 26% of users
 - Abstinence from pornography usage and masturbation – 21% of users
 - Over the counter use of supplements – 20% of users

Overall, nearly half of users self-attributed their ED to psychogenic causes, once again, emphasizing the link between psychosocial issues and ED [19].

Online Pornography

Pornography usage has been increasing due to ease of access with the internet. Porn Hub has a traffic rank of number 6 with 3.1 billion visits in January 2024 [20]. Jacobs et al. surveyed

men between 18 and 35 years old regarding pornography consumption and ED. Pornography consumption was accessed by the cyber pornography addiction test (CYPAT) and the ED was measured by the IIEF. The median age of starting to masturbate to pornography was 13–14 years old. Twenty one percent of the sexually active participants had some degree of ED according to their IIEF scores, however, this mild ED bothered 61% of those affected. This data showed that increased use of pornography increases rates of ED. Importantly, there was a statistically significant correlation between ED and elevated pornography addiction scores (CYPAT) ($p < 0.001$). Lastly, there was a higher rate of ED in those who started watching pornography at a younger age. This study emphasized the importance of screening for pornography consumption, performance pressure, anxiety, and insecurity in those consulting for ED as there is a significant association between these factors [21].

Effects of the COVID-19 Pandemic on Erectile Dysfunction

Our practice had a significant spike in referrals during the COVID-19 pandemic. There are many psychological, social, and organic facets of the pandemic that have contributed to the increased number adolescents and young adults presenting with ED [4]. Duran et al. investigated variations in male sexual health before and after the COVID-19 pandemic. They reported a 4% increase in male reproductive health problems, a 2% increase in male sexual health problems, and a 2% increase of patients diagnosed with ED. Potential social and neuropsychiatric factors contributing to increased presentations include relationship strain due to “stay at home” policies, increased time spent at home, economic problems secondary to unemployment, and anxiety and depression due to the worldwide social climate [22]. Stavridou et al. analyzed studies examining sexual health in adolescents and young adults during the COVID-19 pandemic which revealed a 41% decline in sexual intercourse frequency and 22% decrease in sexual desire, likely secondary to isolation and increasing mental health implications [23].

In addition, SARS-COV-2 can damage the fragile endothelium of blood vessels potentially causing ED. ED may be further affected by SARS-COV-2 as the virus promotes an inflammatory state causing vascular and nerve dysfunction for which both contribute to ED [24].

ED as an Early Marker for Undiagnosed Prediabetes/Type II Diabetes and Cardiovascular Disease in Young Adult Men

Tucker et al. investigated if ED itself may be a risk factor for prediabetes or type II diabetes. They measured the duration between ED and prediabetes/type II diabetes diagnoses

to determine if patients (aged 18–40 years old) with ED were at an increased risk for developing these diseases. It was found that ED was associated with an increased risk for prediabetes/type II diabetes. Seventy five percent of subjects were diagnosed with prediabetes/type II diabetes within a year of their ED diagnoses. Thirty percent were diagnosed with ED and prediabetes/type II diabetes on the same day. This study suggests ED itself may be a risk factor for prediabetes/type II diabetes and offers a unique opportunity for physicians to screen young adults for hyperglycemia and allow early diagnosis of prediabetes/type II diabetes to potentially reduce comorbidity and mortality [25].

In addition, cardiovascular disease (CV), hypertension, and metabolic syndrome are well documented in literature as etiologies of ED in the adult population. Nguyen et al. recommends screening all young adult patients presenting with ED for CV, metabolic, and endocrinologic disease [11]. Inman et al. concluded that ED in young adult men was a statistically significant predictor of future CV events compared to those without ED [26]. ED may be a unique vascular manifestation of underlying vascular disease. Interestingly, 70% of patients with documented CV disease reported ED symptoms prior to CV disease symptoms [11]. In addition, Nguyen et al. reported young men with weak masturbatory erection had a higher prevalence of CV risk factors than those without ED [11]. The accumulation of this data suggests the need for increased screening for CV disease and metabolic disease in young adults presenting with ED as this may be the only presenting symptom fostering early detection of organic disease [11]. We recommend screening for glucose and hba1c levels in at risk groups.

ED Drug Misuse Among Young Adults

Calzo et al. investigated the use of ED medications among 18–31-year-old sexually active men. Two percent of the men reported past-year use of ED medication or supplements, however, 30% of those reported prescription drug misuse, such as using medication prescribed to another person [13]. They also mentioned the use of sildenafil as a recreational drug for young adults to increase duration of sexual intercourse [13]. Wanjari et al. reported a case of a 26-year-old male who represented to the emergency department complaining of headache, flushed skin, and visual disturbances after taking 2 tablets of sildenafil [27]. Practitioners need to be aware of patients taking these medications without physician prescription. The authors recommend greater education regarding the dangerous of using prescription medication recreationally and the need for stricter regulations of purchasing the drug without a prescription [27].

Work-up and Evaluation for ED in Adolescents and Young Adults

The AUA (American Urological Association) guidelines regarding work-up for adult ED includes a thorough medical, sexual, and psychosocial history, physical examination, selective laboratory testing, morning serum total testosterone levels, use of validated questionnaires to assess severity of ED. They also recommend counseling that ED is a risk factor for underlying cardiovascular disease, and referral to a medical health professional to promote treatment adherence, reduce performance anxiety, and integrate treatments into a sexual relationship [9]. These guidelines should be appropriately integrated into the work-up of adolescent and young adults with ED. We believe that the work-up should also include a modified version of the IIEF-5 that includes questions for intercourse and masturbation. We also believe that practitioners should consider using the Beck Anxiety Inventory (BAI) to screen for anxiety and the Patient Health Questionnaire index (PHQ-9) to screen for depression. Currently, a specific questionnaire for adolescents does not exist.

In addition to a full history and physical, patients should be asked about perineal trauma, spinal cord injuries, neurologic symptoms, and vascular abnormalities. We also believe the following should be included in a thorough history:

- Symptoms of anxiety or depression
- Current stressors
- Libido
- Morning erections
- Sexual history
- Sexual orientation
- Setting of ED (masturbation or intercourse)
- Erection rigidity
- Performance anxiety
- Ability to ejaculate
- Premature ejaculation
- Pornography consumption
- ED medication (prescribed, non-prescribed, or over the counter)

Patients should have a focused genital urinary and neurological exam, specifically ruling out anatomic abnormalities. Although the most common etiology of ED in this age group is due to performance anxiety or neuropsychiatric factors, many adolescent males question if they are normal and have normal testosterone levels, for which we recommend checking a serum total morning testosterone level, luteinizing hormone (LH), follicle-stimulating hormone (FSH), and prolactin. When we evaluated 129 adolescents in our practice with ED, the most common laboratory abnormality was elevated prolactin in 8 patients. Two of these patients were also taking anti-depressants, which are known to elevate prolactin and cause ED. Elevated prolactin can lead to decreased libido and effect the hypothalamic pituitary axis. In our cohort of patients who had laboratory values, only 1 had abnormal testosterone [4]. If hormone abnormalities are found, endocrine should be considered. If hyperprolactinemia is present, a brain magnetic resonance imaging (MRI) should be ordered to rule out prolactinoma. If the history or physical reveals concerns for an anatomic abnormality, a pelvic or scrotal US can be obtained. If there is concern for neurologic injuries or spinal cord injuries, MRI of the spine, or neurology consultation should be obtained. Refer to Table 1 for work-up recommendations.

Proposed Treatment for Adolescent and Young Adult ED

If no organic etiologies are found on physical exam, laboratory studies, or imaging, the etiology of ED is most likely non-organic or transient. This is frequently due to generalized anxiety, performance anxiety, depression, or a combination of the three. We always start by removing the stigma of ED in this age group. We inform these patients and their families that we see many patients with this condition, and that it is almost always transient. We also reassure the patients that their physical exam and lab work are all normal.

Table 1 Work-up Recommendations for Adolescent and Young Adult Erectile Dysfunction

| | |
|---|---|
| IIEF-5 questionnaire (focused on masturbation) | Quantify level of ED |
| Beck Anxiety Inventory (BAI) | Questionnaire to access for anxiety |
| Patient Health Questionnaire (PHQ-9) | Questionnaire to screen for depression |
| Prolactin | Rule out prolactinoma |
| Luteinizing hormone (LH) and Follicle-Stimulating (FSH) | Check integrity of gonadotropin pathway |
| Morning total testosterone | Evaluate for low levels of testosterone and provide reassurance |
| Glucose, HbA1c | Evaluate for diabetes |
| Spine MRI | IF INDICATED to evaluate for neurological/spinal cord injuries or etiology |
| Penile Doppler Ultrasound | IF INDICATED to evaluate for vasculature integrity |
| Testicular/Pelvic Ultrasound | IF INDICATED to evaluate for masses, structural abnormalities, injury, hypogonadism |

Table 2 Treatment Recommendations for Adolescent and Young Adult Erectile Dysfunction

| Treatment | Explanation |
|--|---|
| Reassurance | Normalize the issue is in this age group, reassure normal anatomy and laboratory values (especially testosterone level) |
| Cognitive behavioral therapy (CBT) | Treat the psychogenic etiology, especially performance anxiety |
| Tadalafil of 5 mg p.o. daily, may offer additional doses up to 20 mg daily | Promotes daily erections, confidence, and eliminates the pressure of an forming an erection at the time of desire |
| If no improvement with CBT and medications: Adults Urology Referral | Best managed by an adult urologist specializing in male sexual health |

Evaluation by a therapist is recommended for cognitive behavioral therapy to help with performance anxiety. Most patients however desire medication to “help fix their problem”. Tadalafil starting at 5 mg can be prescribed daily and encouraged to be taken (like a vitamin) to help rehabilitate erections and confidence. This helps remove the stigma and stress around ED in these patients. The daily dose can be increased as needed. The side effects of tadalafil include headache, indigestion, flushing, nausea, diarrhea, or changes in color vision [28], including risk of priapism in a young adult with normal physiology. Our initial approach to treating adolescents with ED included sildenafil on an as needed basis. However, this led to more anxiety as patients had to stop the activity and overthink the situation. We found that prescribing tadalafil daily helps erections return on a consistent basis and reduces the anxiety associated with taking a pill before a desirable erection. Patients can be given a 1–3 month course of medication and then the meds can be titrated down and then eventually stopped as most boys will start achieving normal erections.

Wiggins et al. proposed a treatment algorithm for healthy young men with ED for which they also recommend a nightly dose of 5 mg tadalafil with additional doses up to 20 mg daily as needed. Erectile function is assessed after 8 weeks for which the dose is reduced if they receive a positive response. In those with inadequate response, the dose of tadalafil can be increased. If no improvement is reached with medication and behavior therapy, referral to a male sexual health specialist is indicated for likely penile duplex ultrasonography and/or intracavernosal vasoactive injection to evaluate vascular integrity. Extreme refractory treatment options may include intracavernosal injections [29]. Refer to Table 2 for treatment recommendations.

Pearls: Evaluation and Treatment of Erectile Dysfunction in Adolescents and Young Adults

- Targeted history to evaluate for endocrine, neurologic, or neuropsychiatric etiologies.

- Targeted genitourinary exam to evaluate for hypogonadism, testicular, penile, or pelvic abnormality, or structural abnormalities.
- Targeted neurologic exam if concerned for neurologic etiology from history.
- If no obvious pathological etiology, provide reassurance of normal physical exam findings and laboratory values. Most patients want to be reassured that their testosterone levels are normal, which seems to be their most pressing concern.
- Normalize ED in this population and express that many patients are seen with this issue, and it is commonly transient.
- Patients are most satisfied when offered cognitive behavioral therapy (CBT) or medications such as PDE-5 inhibitors in a daily manner over reassurance alone.

Conclusions

ED in adolescent and young adult populations is a complex problem that can be multifactorial. There is no literature regarding the evaluation and treatment of ED in this specific age group, which makes management of this condition challenging for providers. It is essential to recognize the rising incidence of ED in this understudied population and understand the distress and impacts on psychological well-being this condition has on our patients. Potential etiologies of ED in this population include increased rates of depression and anxiety related to social media, the COVID-19 pandemic, and unrealistic expectations regarding sexual encounters with the increased consumption of online pornography. In addition to ruling out anatomic or hormonal abnormalities, reassuring patients that this is a common condition in adolescents and that their anatomy and testosterone levels are normal is helpful. In addition to reassurance and recommendations for behavioral therapy, we have found that offering a daily dose of tadalafil helps to build confidence and eventually rehabilitate erections. If the dose of 5 mg is not therapeutic, the dose can be increased to 10 mg or even up to 20 mg. If there is still no benefit, then these patients should be referred to a urologic sexual health specialist.

Author Contributions A.P. wrote the initial abstract and main manuscript text. A.P., J.G., and I.F. prepared Fig. 1 and Tables 1 and 2. J.G. and I.F. made substantial edits and recommendations to the manuscript. J.G. and I.F. revised the manuscript critically for important intellectual content and approved the version to be published.

Data Availability No datasets were generated or analysed during the current study.

Compliance with Ethical Standards

Conflict of Interest All authors declare that they have no conflicts of interest.

Human and Animal Rights This article does not contain any studies with human or animal subjects performed by any of the authors.

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