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Alcohol Dependence and Sexual Dysfunction : a clinical review

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ABSTRACT

The present paper summarizes sexual dysfunction in alcohol dependence and reviews the literature investigating the relationship between alcohol and human sexuality. Specifically, the authors attempt to reconcile the apparent contradictions found in the effects of alcohol on male and female sexual responding. The review concludes (a) that alcohol disinhibits psychological sexual arousal and suppresses physiological responding, the former effect being stronger at lower doses of alcohol and the latter effect at higher doses; (b) that although suppression is strictly pharmacological in nature, disinhibition appears to be both pharmacological (the result of cognitive impairment) and psychological (the result of socially learned expectancies); and (c) that expectancies and cognitive impairment can disinhibit separately or jointly. Various sexual dysfunctions related to alcohol have been explained and elaborated.

KEYWORDS alcohol dependence, sexual dysfunction, erectile dysfunction, premature ejaculation, testosterone, gonadal hormones.

INTRODUCTION

Nearly all the psychoactive drugs used have an effect on sexual functioning and particularly erectile function. The adverse effects of psychoactive drugs exhibit either through central inhibitory neuroendocrine mechanisms and/or local neurovascular actions, or they have an impact on the hormonal milieu. Ethanol causes increase in inhibitory activity of GABA-A (gamma-amino butyric acid) receptor and decreases the excitatory activity of glutamate receptor in CNS. It suppresses the sex axis and results in hypogonadism. Nicotine has a vasoconstricting effect on the penile vasculature. It also increases oxidative stress and results in endothelial dysfunction. Morphine derivatives are illegal, highly addictive and a central nervous system depressant. They inhibit the release of luteinizing hormone from the pituitary and also cause redirection of blood away from the genitals. Amphetamine a potent and highly addictive psychostimulant is known to enhance the release and block the reuptake of dopamine and norepinephrine. MDMA which is a ring-substituted derivative of amphetamine enhances the release of serotonin, norepinephrine and dopamine. Cocaine is a central nervous system and peripheral nervous system stimulant with anesthetic and vasoconstricting action and is known for inhibiting the reuptake of neurotransmitters.[1]

SEXUAL DYSFUNCTION DUE TO ALCOHOL

Chronic and persistent use of alcohol can cause sexual dysfunction, resulting in marked distress and interpersonal difficulty which in turn, can worsen the alcohol abuse. Sexual dysfunction in the alcoholic may be due to the depressant effect of alcohol itself, alcohol-related disease or due to a multitude of psychological forces related to the alcohol use[2].

There are a various exploratory theoretical concepts regarding the relationship between alcohol abuse and sexual dysfunction. Biological concepts stress neurological damages or endocrinological abnormalities[3,4] , whereas psychological concepts detail the importance of partnership conflicts and other psychological mechanisms which generally maintain sexual dysfunction[5]. There are only a few reports concerning therapeutic intervention with sexually dysfunctional alcohol dependents.[6,7]

Sexual disorders approximately ranging from 8% to 58% have frequently been reported in men who are chronic alcoholics.[8] Lemere and Smith reported that 8% of 17,000 patients treated for alcoholism had impotence.[9] The reported prevalence of lack of sexual desire ranges from 31% to 58% of subjects using alcohol long-term.[10,11] Whalley reported that 54% of hospitalized alcoholic men and 24% of healthy controls had erectile impotence.[12] Jensen reported that 63% of married alcoholic men and 10% of controls had sexual dysfunctions, especially lack of sexual desire.[11]

Bijil Simon Arackal and Vivek Benegal found that of 100 male inpatients admitted for the treatment of alcoholism, 72 suffered from sexual dysfunction and 36 out of 96 (37.5%) subjects had premature ejaculation. The next most frequent sexual dysfunction reported by 36 out of 100 subjects was low sexual desire. Erectile dysfunction was reported by 33.3% of the subjects with difficulty in achieving erection in 19 subjects (19.79%) and difficulty in maintaining erection in 13 subjects (13.54%). Fourteen subjects (14.58%) had a lack of pleasure at the time of ejaculation (anorgasmia) and 10 (10.41%) had inhibited or delayed ejaculation. People with tobacco use were no more likely to have more sexual dysfunction than those without tobacco use[13].

Episodic erectile failure in alcoholic men is fairly routine, found to be significantly higher in men consuming more than three standard units of alcohol (12 g ethanol) daily and in subjects smoking more than 10 cigarettes/day.[14] Van Thiel and Lester[83] reported that 61% of alcohol dependent patents had sexual dysfunction, the most common being erectile dysfunction followed by reduced sexual desire. Erectile dysfunction and reduced sexual desire were frequently seen to be coexisting. [15, 16] Vijayasenan,[17] found that of 97 male inpatients admitted for the treatment of alcoholism, 71% suffered from sexual dysfunction for a period of more than 12 months prior to admission to a hospital. The disturbances noted were diminished sexual desire (58%), ejaculatory incompetence (22%), erectile impotence (16%) and premature ejaculation (4%). Virtually all aspects of the human sexual response are affected by alcohol especially sexual desire and erection.[18]

Schiavi et al.[19] failed to find any difference in sexual dysfunction in alcoholics abstinent for 2-3 months in comparison with a nonalcoholic control group, speculating that alcohol-induced

sexual dysfunction was reversible with abstinence.

Alcoholic men have reported impotence and diminished heterosexual desire and activity. Objective behavioural studies have been completed on the effects of alcohol on sexual arousal in response to an erotic or control film. It has been consistently observed that alcohol attenuates sexual responsivity, as defined by measures of penile tumescence, in healthy young men. Reports of sexual arousal and estimates of penile erection were positively correlated with penile tumescence in men.[20, 21]

Despite evidence to the contrary, subjects often continued to believe that alcohol enhanced their sexual function. These data illustrate the difficulty in reconciling objective and subjective information about sexual behaviour. Rubin and Henson[22] have concluded that an individual whose threshold for penile erection and/or ejaculation has been raised by the ingestion of alcohol may consider this depressant effect to be an enhancement of sexual abilities because it increases the time available for sexual stimulation of his partner which could well increase the probability of her being brought to orgasm.

Effects of alcohol on sexual function by amount of alcohol
Small doses of alcohol can cause: Release of inhibition increased aggression, increased desire, increased arousal, control of premature ejaculation, decreased penile tumescence

Moderate doses of alcohol can cause: longer foreplay, increased time to erection, difficulty in maintaining erection, uncertain orgasm, decreased penile tumescence.

Large doses of alcohol can cause: Impotence both erectile and ejaculatory, thoughtlessness, unpleasant ejaculation, aggressiveness.

Chronic alcoholism may lead to loss of libido, loss of sexual satisfaction, erectile impotence, decreased testosterone, infertility, breast development, decreased body hair, shriveled testicles [23]

ALCOHOL AND ERECTILE DYSFUNCTION

In textbooks,[24], [25] review articles[26, 27] or clinical teachings alcohol is since long considered to be responsible for ED. It was a long-held empirical observation that acute alcohol intoxication increases sexual desire but inhibits sexual performance. The scientific explanation is that alcohol is a central nervous system depressant, but it also leads to disinhibition and increases sexual desire.[24] Epidemiological studies have shown numerous risk factors for ED, such as age, variables related to diabetes, depression, hypertension and smoking. With more evidence gathered, the risk of alcohol consumption in ED seemed more equivocal. ED has also been said to be the harbinger of cardiovascular events. Endothelial dysfunction has been hypothesized to result from cardiovascular risk factors such as hypertension or diabetes, which in turn leads to ED, myocardial infarction and stroke.[28]

There are various possible mechanisms by which alcohol may cause erectile dysfunction. Erectile dysfunctions have more than one cause. Central nervous system effects tend to be more pronounced when levels are rising than when falling. Ethanol (ethyl alcohol) impairs a spinal reflex which causes both decreased sensation and decreased innervation for erection, but it has also been shown to decrease serum testosterone levels[23].

The phenomenon of erectile dysfunction is caused by the stimulating and then destructive effect of alcohol on the neurologic reflex arc subserving erection. This arc theoretically includes[29]:

1) The cerebral cortex, from which sexual thoughts arise,
2) the anterior portion of the temporal lobe, which determines intensity of libido,
3) perhaps the hypothalamus,
4) the spinal cord reflex centers for erection, and
5) the peripheral nerves that convey sensory and vasomotor impulses to and from the genital organs.

Sung Chul Kam[30] sought to investigate the effects of ethyl alcohol on corporal tissue tonicity, as well as the intracellular calcium concentration ($[Ca^{2+}]$) and potassium [K] channel activity of corporal smooth muscle. Ethyl alcohol induced a sustained increase in $[Ca^{2+}]$ in a dose-dependent manner, Extracellular application of ethyl alcohol significantly increased whole-cell K^+ currents in a concentration-dependent manner. Ethyl alcohol caused a dose-dependent increase in cavernosal tension by alterations to $[Ca^{2+}]$. Although ethyl alcohol did not affect KCa channels directly, it increased the channel activity by increasing $[Ca^{2+}]$. The increased corpus cavernosal tone caused by ethyl alcohol might be one of the mechanisms of ED after heavy drinking

LANDMARK STUDIES ON ERECTILE DYSFUNCTION DUE TO ALCOHOL

The Health Professionals Follow-up Study (HPFS)[31, 32] provided much evidence on the influence of lifestyle factors on the development of ED.

The HPFS cross-sectional study[31] involved 31 742 men aged 53–90 and was probably the largest cross-sectional study on ED to date. The multivariate-adjusted Relative Risk (RR) for ED was decreased with moderate levels of alcohol consumption. The RRs were 1.0 (0.9–1.2), 0.9 (0.8–1.0), 0.8 (0.7–1.0) and 1.0 (0.8–1.2) for 0.1–4.9, 5.0–14.9, 15–29.9, ≥ 30.0 g/day of alcohol consumption respectively , after adjustments for comorbidity, medication, smoking status, physical activity, television watching, body mass index (BMI) and other factors.

The HPFS prospective cohort study[32] demonstrated the independent effects of physical activity (RR 0.7, 95% CI, 0.7–0.8), obesity (multivariate RR 1.9, 95% CI, 1.6–2.2) and smoking (RR 1.5, 95% CI, 1.3–1.7) on the development of ED. Around 51 529 health professional men were recruited at baseline, after inclusion of those who were healthy at baseline and exclusion of those lost to follow-up, 22 086 men were computed in the analysis. No significant difference in risk of developing ED was found in all categories of alcohol consumption: multivariate adjusted RR 1.0 (0.9–1.1), 1.0 (0.9–1.1), 1.0 (0.9–1.1) and 1.1 (1.0–1.2), for 0.1–4.9, 5.0–14.9, 15–29.9, ≥ 30.0 g/day of alcohol consumption respectively. Statistical adjustments were made for age, marital status, smoking, alcohol and BMI

The Massachusetts Male Aging Study (MMAS)[33] involved a baseline cohort of 1709 men, but the analysis was restricted to only 513 men without ED at baseline. The adjusted incidence for ED was 16% (95% CI, 12–22), 16% (11–23) and 15% (8–24) in those with <1 drink/day, 1–3 drinks/day and ≥4 drinks/day of alcohol consumption respectively. This incidence figure was adjusted for age, active and passive smoking, overweight, hypertension, physical activity, cholesterol, fat intake, testosterone, depression and antihypertensive medication intake. It is also found that the OR (adjusted for the same variables) for ED was 0.95 (95% CI, 0.54–1.67) and 0.87 (0.41–1.86) in those with 1–3 drinks/day and ≥4 drinks/day of alcohol consumption respectively, using <1 drink/day as reference, although the result was not statistically significant.

O'Farrell et al. found that alcoholic men had over three times the prevalence of serious ED (i.e., at least 25% of the time) of demographically similar nonalcoholic men.[34]. Another study by Snyder and Karacan measured nocturnal penile tumescence in a sample of 26 alcoholic men going through detoxification. They found that alcoholic men were more likely to have fewer, slower, and less rigid nocturnal erections than a nonalcoholic comparison group.[35]

PREMATURE EJACULATION DUE TO ALCOHOL USE

Studies have quoted the presence of premature ejaculation in alcoholics. Secondary premature ejaculation is sometimes

found in association with alcohol-related peripheral neuropathy[36].

In a study by C. Basile Fasolo et al among lifestyle habits (smoking, alcohol, and physical activity), only alcohol drinking had a relation in this study with an increased risk of Premature Ejaculation.[37]

Mandell et al. interviewed 44 male volunteers consecutively admitted to outpatient treatment in a county alcoholism program. Fifty-three per cent of the subjects were still drinking minimally or in moderation at the time of the interview. Quantity, frequency, and duration of drinking, from onset of regular drinking to present, were related to sexual dysfunctions. During heavy drinking. 59% of patients experienced erection dysfunction, 48% reported ejaculation incompetence, and 84.4% had experienced at least one kind of sexual dysfunction[38].

STUDY QUOTING NO DIFFERENCE IN SEXUAL DYSFUNCTION DUE TO ALCOHOL

Gumus et al[39] conducted a study on forty-five chronically alcoholic men and a control group of thirty healthy non-alcoholic volunteers. Each of the men in the study and control group were interviewed on the basis of a sexual dysfunction questionnaire by an urologist. Blood samples were collected for evaluation of hormone levels. The sexual desire and erection scores of alcoholic men were not statistically different from those of the control group. Fourteen out of the 45 alcoholic men complained of loss of erection during sexual activity however it was not statistically significant. No significant difference in hormone levels between groups was found except for Follicle Stimulating Hormone (FSH). He concluded that in the absence of hepatic and gonadal failure in chronically alcoholic men, there is no significant difference in serum hormonal levels, sexual dysfunction form, and sexual functions between alcoholics and normal healthy non-alcoholic men.

EFFECTS OF ALCOHOL ON PITUITARY AND GONADAL HORMONES

Shakespeare[40] was among the first to comment on alcohol-induced changes in pituitary-gonadal function.

Macduff: What three things does drink especially provoke?

Porter: Marry, sir, nose painting, sleep and urine. Lechery, sir, it provokes and unprovokes. It provokes the desire but takes away the performance.

Although extensive studies on the effects of alcohol on pituitary secretions of vasopressin and ethanol-induced diuresis have been done[41], the relations between the effects of alcohol on pituitary-gonadal hormones and sexual function have only recently been elucidated.

The activity of the hypothalamic–pituitary–adrenal (HPA) axis[42] and the hypothalamo–pituitary–gonadal (HPG) axis[19] is affected by alcohol. Though the underlying mechanisms have not been completely identified, animal and laboratory studies indicate that alcohol suppresses the activity of the HPG axis by inhibiting the secretion of hypothalamic-gonadotropin-releasing hormone (GnRH) and/or pituitary luteinizing hormone (LH)[43,44]

RELATIONSHIP OF ALCOHOL INDUCED LIVER DISEASE AND; PITUITARY AND GONADAL FUNCTIONS

In 1926 clinical reports of gynecomastia and testicular atrophy in alcoholics with cirrhosis of the liver began to appear in the medical literature[45]. Many reports of similar phenomena were later published and several investigators explored the relations between alcohol-induced liver disease and derangements in steroid homeostasis.[46] Testicular atrophy and gynecomastia developing in alcoholic men with liver disease as a consequence of a specific disorder involving estrogen metabolism have not been established.[47] It is doubtful whether cirrhosis itself is a primary factor in feminization of male alcoholics. Summerskill and his co-workers[48] have reported a higher incidence of gynecomastia in men with alcohol related cirrhosis than in men with cirrhosis unrelated to alcohol. Galvao-Teles and his associates also obtained similar findings.[48]

Van Thiel and his associates[49] conducted detailed studies of 40 men with alcohol-related hepatic disease, and reported that, primary gonadal failure as well as hypothalamic-pituitary suppression are demonstrable in men with alcoholic liver disease. Male alcohol addicts who had little evidence of liver disease were also observed to have gynecomastia and testicular atrophy.[50] Van Thiel and Lester[51] concluded that alcohol use itself, without associated liver disease, might produce disorders of gonadal steroid function. This hypothesis has been substantiated in a number of recent studies in human beings and animals.

Iturriaga et al[52] assessed the relationship of ethanol ingestion induced hypoandrogenism in male subjects with its relationship with the degree of liver damage and alcohol abstinence. After two different abstinence periods they measured plasma sex hormones in 30 alcoholic patients without liver failure. It was found that on admission total Testosterone levels were similar to controls. Histologically, 9 patients had normal liver; 14 had moderate alterations and 7 showed marked alterations. Hormonal values were not different in these 3 groups. Around 11 days after admission, when these patients were to be discharged it was observed that Testosterone, Estrogen and FSH did not show significant changes but LH decreased. They concluded that alcoholic patients without clinical signs of liver failure have normal plasma testosterone levels, irrespective of their histologic liver alterations.

EFFECT OF ALCOHOL ON TESTOSTERONE

Naturalistic studies show, chronic alcohol intake reduces plasma testosterone levels in men.[53] Interestingly, plasma testosterone levels decrease in dependent men after experimental exposure to the sight and smell of alcohol even without alcohol consumption[54]. In fact in the studies conducted by Ruusa et al in non-cirrhotic alcoholic men, there was an increase in testosterone concentrations during withdrawal and returned to normal limits after three weeks of abstinence[55]

It appears that alcohol-induced decrement in testosterone may have several interacting biologic processes. Vitamin A metabolism in the testes is inhibited by alcohol[56], and this effect may contribute to an inhibition of steroid production in the testes. Alcohol not only accelerates the rate of testosterone degradation in the liver[57] but also decreases testosterone production.[58]

The recent studies with healthy, nonalcoholic men have supported the hypothesis that alcohol-induced suppression of testosterone is primarily due to ethanol's effect on the target organ (the testes) rather than an ethanol-mediated effect on the pituitary trophic hormone (luteinizing hormone). Data indicate that ethanol inhibits testosterone biosynthesis in the testes at the intracellular level rather than the membrane level of the Leydig cell.[59]

Ethanol-induced inhibition of testosterone biosynthesis in Leydig cells probably occurs because levels of nicotinamide adenine dinucleotide are reduced in the testes when ethanol is oxidized.

A factor contributing to the decreased plasma concentration of testosterone in chronic alcoholics is the ethanol induced increase in the metabolic clearance rate of testosterone, which is due, at least in part, to the increased activity of the hepatic 5 α-reductases, microsomal enzymes responsible for their reversible metabolism of Δ 4-3-ketosteroids such as testosterone.[60] This enzyme converts testosterone to dihydrotestosterone, which in the liver is a catabolic reaction. An additional factor to be considered as a mechanism leading to low plasma levels of testosterone is the ethanol induced enhancement of adrenal cortisol secretion[61], because it has been shown that exogenously administered cortisol and dexamethasone can depress testicular production of testosterone[62]

The importance of alcohol-induced derangements in testosterone biosynthesis and associated changes in luteinizing-hormone secretory activity extends beyond the dramatic cases of feminization in adult male alcoholics. A number of clinical surveys have suggested that alcohol affects libidinal function and sexual behaviour in otherwise normal men.[63] Masters and Johnson[64] have reported that the second most frequent factor associated with impotence in the men whom they examined was "directly related to a specific incidence of acute ingestion or to a pattern of excessive alcohol intake per se."

The mechanisms underlying alcohol-induced sexual arousal are not well understood although it can be understood that a decrement in sexual performance is associated with an alcohol-induced decrement in testosterone levels in men. The findings by LaFerla and his associates[65] indicate a correlation between degree of sexual arousal and increments in plasma luteinizing-hormone levels in men. It is possible that a surge in levels of the hormone associated with a decrement in plasma testosterone after acute alcohol intake[66] is implicated in alcohol-induced sexual arousal.

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