

Addiction to Propofol: A Study of 22 Treatment Cases

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Objective: To review and report the history and clinical presentation of a cohort of health care professionals (HCPs) who have abused the drug propofol.

Methods: The authors queried a clinical database (the *HCP Database*) that contained information about HCPs treated at a large addiction center between 1990 and 2010. Patients who reported propofol use were removed from the HCP Database and placed in a second database referred to herein as the *Propofol Database*. The medical records of each of the cases in the Propofol Database were pulled and carefully reviewed; a clinical case history of each case was prepared. The Propofol Database was expanded by this chart review, adding demographics, drugs used, course of substance use, other clinical history, presenting signs, diagnoses, and comorbid conditions. At this point, the case histories and databases were anonymized. When variables were present in both data sets, significance was tested between the HCP Database and the Propofol Database. When comparable data were not present in the HCP Database, the authors reported simple percentages within the Propofol Database. This study focused on gender, medical education and specialty, drugs used, course of illness, and comorbid conditions.

Results: Compared with the composite treatment population of HCPs during the same time, records showed that the propofol group was more likely to work in the operating theater, be female, and have training as an anesthesiologist or certified registered nurse anesthetist. Presentation into treatment from the propofol cohort more commonly occurred soon after beginning propofol use, often presenting in a dramatic fashion such as motor vehicle accidents or other physical injuries. When such injuries occurred, it was a direct result of acute propofol intoxication. The number of cases arriving in treatment increased over the duration of the study. The propofol group frequently suffered with a depressive illness and had a history of earlier life trauma. They had a high frequency of biological relatives with substance dependence. The most common subjective response as to why they began using propofol was to induce sleep. Most of these patients identified propofol as one of their preferred drugs of abuse.

Conclusions: This study suggests the incidence and/or detection rate of propofol abuse in HCPs is increasing. Women and anesthesia

personnel were overrepresented in the propofol cohort. Propofol-dependent patients commonly have a history of depression and earlier life trauma. A rapid downhill course and physical injury are common adverse effects of propofol abuse. The time from initial use to treatment entry is often contracted when compared with other drugs of abuse making the diagnosis of a true dependence disorder and disposition after treatment more difficult.

Key Words: propofol, case study, health care providers, addiction treatment

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Propofol is an anesthetic induction agent, first released in its current form in 1986. It is omnipresent as an induction agent in operating rooms in 50 countries and is used in procedural sedation. It is considered the induction agent of choice in many medical situations in the United States (Eger, 2004) and the United Kingdom (Payne et al., 2003). Propofol is in widespread use in veterinary medicine (Short and Bufalari, 1999).

Propofol was originally developed and marketed as an induction agent. Once on the market, it quickly replaced thiopental for this purpose. Its use has expanded over time and today it is a commonly used primary anesthetic for procedural sedation or short operative procedures. Induction into anesthesia is rapid. Recovery is just as quick and does not require the use of an antagonist. Patients awaken feeling refreshed with little anesthetic hangover. These properties account for its widespread adoption.

Propofol has a relatively benign adverse effect profile when used in the proper setting. The first common adverse effect is a drop in both systolic and diastolic blood pressure by 25% to 40%. The second effect is a reduction in respiratory drive and upper airway protection, which can lead to hypoxia and arrest when used outside of the proper medical arena or when its use is unsupervised (Marik, 2004). Propofol's anesthetic properties have been used to manage intractable Status Epilepticus and Delirium Tremens (McCowan and Marik, 2000). It also has interesting anti-inflammatory properties, which may prove effective in sepsis and traumatic brain injury (Thurman and Guerrero, 1999). Finally, propofol may be valuable in the treatment of status asthmaticus in the intensive care unit when sedation is required (Marik et al., 2002).

The exact neurophysiology of propofol's anesthetic effect is unclear. Its action in anesthesia induction may partially be through potentiation of gamma-aminobutyric acid (GABA) ionophore complex, in a manner similar to sedating drugs of abuse (Concas et al., 1990; Trapani et al., 1998, 2000). It also

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acts as a sodium channel blocker (Haeseler and Leuwer, 2003) and inhibits phosphorylation of N-methyl-d-aspartate receptor NR1 subunits of central nervous system neurons (Kingston et al., 2006). The medication also may interact with the endocannabinoid system, although this effect may not be related to anesthesia, *per se* (Fowler, 2004).

Recent research demonstrated that propofol induces the production of the addictive signaling molecule Δ FosB in the rat nucleus accumbens through the dopamine D₁ receptor system (Li et al., 2008; Xiong et al., 2011)—a putative signaling mechanism for most, if not all, addictive drugs (Nestler et al., 2001; Nestler, 2005, 2008). Animal behavior studies show that rats and primates self-administer propofol when given the opportunity (Weerts et al., 1999; LeSage et al., 2000). These behavioral studies are mirrored by *in vivo* brain microdialysis research, where the drug increases dopamine levels in the rat nucleus accumbens (Pain et al., 2002). Interestingly enough, this effect only occurred when experimental dosing reached subanesthetic and anesthetic doses.

Sleep and propofol are intertwined in case reports. Tung et al (2004) reported that propofol anesthesia is similar to the recovery process occurring during natural sleep. This suggests that sleep and propofol anesthesia share common regulatory mechanisms. In early human studies of propofol's effects in humans, Brazzalotto (1989) estimated that 40% of patients awoke with pleasurable feelings. Drug naïve volunteers selected propofol over placebo and reported pleasant effects two thirds of the time (Zacny et al., 1993). In this report, Zacny et al. reported "liking" and preference over placebo for propofol in human volunteers, implying that the drug's reinforcing qualities might be due to the induction of incentive salience circuits in the brain.

When humans abuse propofol, unintended adverse effects begin almost immediately. The narrow window between desired effect and unconsciousness (the steep dose/response curve) creates an intense risk of overdose (Ward, 2008). Its short acting nature produces a few moments of euphoria or "high" commonly followed by somnolence or a brief sleep. Craving occurs with repeated use. One such case of intense propofol craving led to 20 to 40 injections per day and reaching a daily total of up to 4 g of the drug (Bonnet and Scherbaum, 2012).

The first case of propofol addiction was reported in 1992 by Follette and Farley (1992). Since that time, several cases of propofol dependence have appeared in the literature, including one in a non-medically affiliated individual (Fritz and Niemczyk, 2002). Death as a consequence of propofol abuse is commonly described among anesthesia providers who abuse substances, and several cases have been reported in the literature (Iwersen-Bergmann et al., 2001; Fritz and Niemczyk, 2002; Kranioti et al., 2007).

Recently, several authors have hypothesized that micromolar levels of propofol in the operating room air may sensitize operating room personnel to later abuse (McAuliffe et al., 2006; Merlo et al., 2008). This startling hypothesis is corroborated by research by Li et al (2004), which shows nanomolar concentrations of propofol enhance presynaptic dopamine D₁ receptor-mediated facilitation of glutamatergic synaptic transmission and the excitability of dopamine neurons in the ventral

tegmental area of the rat brain. This is similar to the ventral tegmental area activation of other drugs of abuse (Nestler, 2004).

The purpose of this case study was to determine characteristics of propofol use and abuse among HCPs. Many single case reports of propofol dependence appear in the literature, and several multicase reviews synthesize case reports (Wischmeyer et al., 2007; Lee and Yoo, 2009; Welliver et al., 2012). However, this is the first retrospective review of more than a few cases of propofol abuse, the first treatment data analysis, and the first study to address the natural history of the disorder, its progression, and comorbid conditions.

Clinical experience promoted the hypothesis that many of the HCP patients who abuse propofol worked in anesthesia were more commonly female and suffered from significant depressive disorders. Staff also hypothesized that the actual incidence of propofol dependence was increasing for unknown reasons.

METHODS

The research reported here emerges from a retrospective case study based on review of medical charts of patients admitted to a residential treatment center known for its focus on substance dependence among HCPs. The data collection procedures and Health Insurance Portability and Accountability Act protection protocols were reviewed and approved by the center's Corporate Review Board for safety and patient protection. The authors queried an existing medical records database (identified as the *HCP Database*) that contained 1413 HCPs treated between 1990 and 2010. Patients who reported any propofol use or abuse during intake were culled and subsequently removed from the HCP Database before data analysis. Because the HCP Database was built primarily from the admission and early treatment evaluations, patients who did not report propofol use to their treatment providers early in treatment may be excluded from this study.

Once propofol using individuals were identified, the corresponding charts were retrieved from the medical records archive, the record was studied, and a clinical case summary of each case was prepared. When the chart review was complete, protected patient data were removed before data analysis. Each clinical summary included age, gender, admission year, profession type, psychiatric and social history, diagnoses, course in treatment, and propofol use patterns over time. The patient's drugs of choice were determined by the patient's self-report combined with the clinical judgment of their physician and staff evaluations. Four of the propofol cases appeared in treatment after a single propofol binge. These 4 cases were removed from the pool when considering *DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition)* criteria. Long-term outcome data were not available at the time of this study. A second database (identified as the *Propofol Database*) was built that aggregated the patient information described earlier.

DATA ANALYSIS

The study compared information from the HCP Database with that from the Propofol Database (22 cases) when

comparable information was available. Comparison points included the following:

- Gender
- Age at presentation
- Medical training
- Medical specialty
- Alcohol is identified as a drug of choice

Data significance for these 5 areas was calculated using the Student *t* test; the null hypothesis in these comparisons was stipulated as being no difference between the 2 data sets. Much of the information collected by chart review had no comparable information in the HCP Database. This information was reported using simple percentages.

RESULTS

Incidence and Demographics

Of 1413 HCP cases treated during the period from 1990 to 2010, 22 cases (1.6%) reported propofol use. The cases were divided into semidecade (5 years) treatment year groups (1990-1995, 1996-2000, 2001-2005, and 2006-2010); a breakdown using this grouping appears in Figure 1. Each subsequent semidecade resulted in at least a 25% increase in the numbers of admissions who reported propofol use. Forty-five percent of propofol users were female compared with 26% in the HCP Database ($t = 2.03, P < 0.043$). The median age at presentation for the propofol group was 40.0 (mean = 42.2, standard deviation = 9.3 years, minimum = 30, maximum = 58) versus 43.1 (mean = 43.9, standard deviation = 9.8 years, minimum = 22, maximum = 83) in the entire HCP population (not significant, $t = 0.766, P > 0.44$).

The breakdown by profession in the 22 propofol cases appears in Table 1. All of the 22 cases had work-related access to propofol. Eighty-four percent of all propofol cases were anesthesia providers. Fifty-nine percent of the propofol cohort were physicians compared with 49% in the entire HCP population during the same period (not significant, $t = -0.94, P > 0.34$). Thirty-six percent of the propofol group were nursing trained (100% of which were certified registered nurse anesthetists [CRNAs]) compared with 20.2% in the HCP Database ($t = -1.81, P = 0.07$). One case was a dentist with propofol

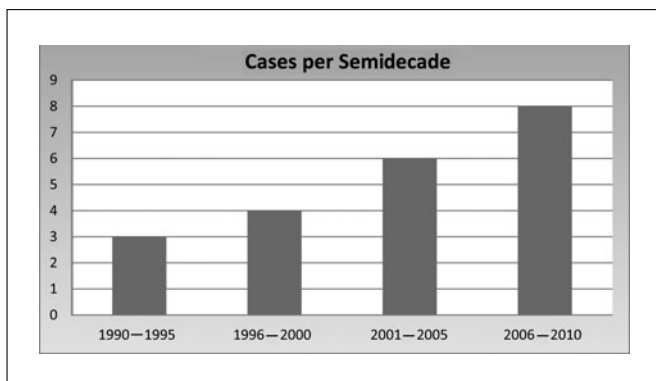


Figure 1. Increasing incidence of Propofol cases.

TABLE 1. Profession of Propofol Cases

Profession	Number
All physicians	13
Anesthesiologists	11
Obstetrics & Gynecology	1
Surgeon	1
Nurses (all CRNAs)	8
Dentist	1
Total	22

CRNA indicates certified registered nurse anesthetist.

TABLE 2. Characteristics of HCP Propofol Abusers

Variable	Number (%) in HCP Database	Number (%) in Propofol Database	<i>t</i>	<i>P</i>
Female gender	367 (26%)	10 (45%)	2.03	<0.043
Nurse-trained	285 (20%)	8 (36%)	1.81	0.07
If MD, is an anesthesiologist	197 (14%)	11 (85%)	-7.28	<0.00002
Alcohol is drug of choice (negative correlation in Propofol Group)	410 (29%)	2 (9%)	-1.96	0.03

HCP indicates health care professional.

access. Although 14% of *all* physicians in treatment during the study period ($n = 197$) were anesthesiologists, 85% of physicians in the propofol group identified themselves as anesthesiologists ($t = -7.28, P < 0.00002$). Eighteen percent of the propofol cohort were resident physicians; the HCP Database lacked comparison data to determine if resident physicians were overrepresented. Ten of the 22 cases of propofol use were anesthesiologists. During the study period, the center treated 197 anesthesiologists, and thus 5% of the anesthesiologists in treatment had used propofol.

Drug Use and Course of Illness

This study reviewed the drugs used by this population. Propofol was the user's drug of choice in 11 of the cases (50%). In 2 of these cases, their initial drugs of choice were fentanyl and another 2 were alcohol but had converted to propofol after developing a preference. Four (18%) used propofol in combination with fentanyl and indicated both as their drugs of choice. One used it as a substitute for marijuana. The remaining 7 indicated propofol was part of their repertoire of drug use, which included fentanyl (5), alcohol (3), zolpidem (2), unspecified stimulants (1), marijuana (1) tramadol (1), unspecified benzodiazepines (1), and cocaine (1). These were included in the study because propofol was the drug primarily responsible for their admission either as a relapse drug or as part of an inciting event (eg, they were found unconscious or it was the cause of an accident). This drug list is reflective of anesthesia provider HCPs in treatment, with one exception: the propofol cohort used less alcohol when compared with anesthesiologists in the HCP Database and compared with alcohol use among anesthesiologists in other studies (McAuliffe et al., 1991; Hughes et al., 1992a, 1992b). Only 2 patients (9%) reported alcohol as

their primary drug of choice, compared with 29% of patients in the HCP Database ($t = -1.96, P = 0.03$). Thirty-six percent in the propofol group were tobacco users. Eight (36%) entered treatment after a relapse on propofol.

Regarding the course of addiction, the vast majority of cases (68%) presented within 4 months of using propofol (Fig. 2) and, surprisingly, 4 cases (18%) arrived in treatment after a single propofol binge. Of these 4 individuals, 2 had previously abused fentanyl. The other 2 had no significant history of drug abuse before the propofol binge that brought them to treatment. Entry into treatment in 5 cases (27%) resulted from being discovered unconscious from propofol.

Fifty percent of individuals in the propofol cohort suffered from propofol-related physical injury; 5 were motor vehicle accidents, and the remainder resulted from falling into unconsciousness (eg, falling from an operating room table, body bruising or lacerations, facial or nasal fractures, or other facial trauma from “head banging”). This type of facial injury arises from injecting propofol while sitting in a chair or at a desk, going unconscious and subsequently falling forward onto the desk or floor. The face is the most common body part traumatized by loss of motor tone while falling unconscious. One case reported multiple propofol-induced seizures.

Diagnosis and Comorbid Conditions

Regarding substance use characteristics (Table 2) and comorbid mental health and psychiatric conditions in the propofol cohort, 82% (18) met *DSM-IV* criteria for propofol dependence. Fifty percent of propofol users reported tolerance (*DSM-IV* Criterion 1), and 18% reported propofol withdrawal upon discontinuance (*DSM-IV* Criterion 2). Of the 7 *DSM-IV* criteria for substance dependence, each patient in the propofol-dependent group endorsed 5 of the 7 remaining *DSM-IV* criteria (American Psychiatric Association, 2000) more than 80% of the time. The endorsed criteria were:

3. The substance is often taken in larger amounts or over a longer period than intended.

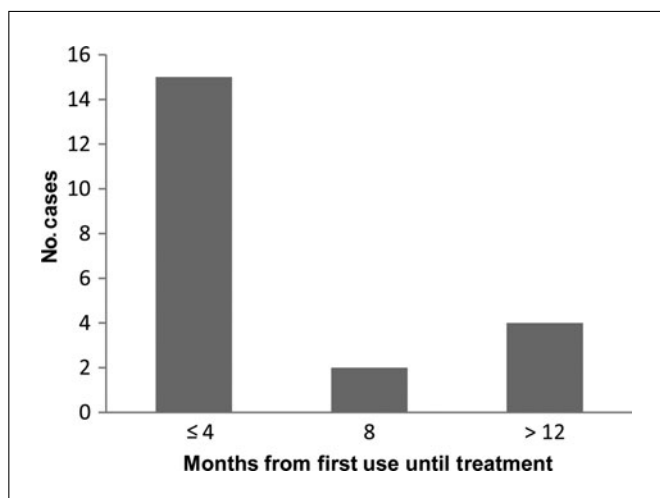


Figure 2. Rapid progression of Propofol abuse.

4. There is a persistent desire or unsuccessful efforts to cut down or control substance use.
5. A great deal of time is spent in activities necessary to obtain the substance, use the substance, or recover from its effects.
6. Important social, occupational, or recreational activities are given up or reduced because of substance use.
7. The substance use is continued despite knowledge of having a persistent physical or psychological problem that is likely to have been caused or exacerbated by the substance.

The patients' subjective reports as to why they started using propofol were reviewed. Forty-one percent reported insomnia or a need to sleep as a reason to try propofol, 27% for anxiety, and 18% were seeking euphoria.

The majority of cases (78%) had a current or past history of a unipolar depressive disorder. One case was diagnosed with a personality disorder (Avoidant Personality Disorder). Four cases were diagnosed with narcissistic features; dependent characteristics were diagnosed in 3, histrionic features in 2, and passive-aggressive features in 2 cases. Three of the 22 cases were diagnosed with schizoid features. No cases were found to have a history or a current diagnosis of Bipolar I.

In the propofol cohort, 61% (14) reported a history of childhood abuse. Of these, 10 suffered direct trauma (either physical or sexual) and 4 were witness to intense physical or sexual abuse, or assault of a primary family member. Fifty-four percent (7 of 13) of those who were admitted after a relapse had a history of such trauma.

In the patients' family histories, 83% reported a significant biological family history of substance dependence. Fifty-nine percent reported a family history of depression, and 18% reported a family history of schizophrenia.

DISCUSSION

Detection of Propofol Use

Two *prima facie* prevalence biases appear in the case sampling. The first is the number of cases most likely suffers from underreporting in general. Throughout the study period, propofol was not part of the panoply of drugs listed in the center's standard “drug use” intake form. This would produce an underreporting of propofol use. The second bias comes from an expanding awareness about propofol throughout the 20 years of data. During this time, the counselors, intake staff, and physicians evolved from seeing propofol use as a medical oddity to a more common drug of abuse among health care professionals. A modicum of awareness about propofol abuse developed over time. As a result, staff would inquire about propofol use more frequently in the later years of the study. This might have produced some of the increase in cases reported over each subsequent semidecade of the study.

Dramatic presentations of propofol use also increased sharply over the study period. When cases were admitted after having been found unconscious, after physical trauma from propofol use, or after having been discovered using the drug, the admission record would naturally record this as a case of propofol dependence—whatever the year. In this manner, such presentations remove interviewer bias. With this in mind, it was noted that 5 of the 6 cases that presented in one of

these ways occurred in the last semidecade. This suggests that the incidence of treatment cases is increasing and posits that propofol abuse and dependence in HCPs is increasing over time as well.

The increased frequency of physical trauma in this patient cohort is important diagnostically. This is especially true when a HCP presents with a suspicious story or characteristic trauma pattern (eg, facial contusions). Health care professionals who work in a high drug access work environment and present with repeated physical trauma should be tested for all drugs of abuse, including propofol. Propofol is not on common test panels and the alerted examiner must specifically request it. Urine, blood, and hair are all useful sources for screening.

Characteristics of Propofol Abuse

It is not uncommon for intravenous drug users who are HCPs to insert butterfly needles or other indwelling ports to administer drugs, most commonly opioids. Because of intense compulsions, dependent professionals will at times use this easy access to administer drugs while engaged in other high-intensity activities, such as working or driving. This compulsion was also prevalent in several of the propofol cases, where propofol was administered through indwelling venous access ports. In these cases, such use occurred despite the fact that the HCP reported knowing that a slight miscalculation of dose would result in complete unconsciousness.

One 37-year-old dentist changed his drug of choice from fentanyl to propofol after his addictionologist started him on oral naltrexone. Having previously set up an intravenous port, he injected himself with propofol repeatedly while driving his car. His wife phoned him, asking him to come home. While trying to get home in a confused state, he backed his van into pedestrians.

In another dramatic case, a 40-year-old CRNA initially began experimenting with intravenous fentanyl. She recalled the effect of propofol and fentanyl from a prior surgical procedure just a few weeks earlier. She recounted how they “removed all of her emotional pain” and she “knew immediately she was addicted.” Her use started by injecting fentanyl in the evenings after work. Over a period of 3 months, it escalated to injecting approximately 60 to 130 μg , four times a day.

She developed a sleep disturbance (a least partially related to the fentanyl use) and decided to try propofol to help with this problem, initially injecting just enough to initiate sleep. Within several weeks, she had placed an indwelling intravenous catheter for her use. On the way home after work, she would drive her car to a secluded spot and park. There, she would typically inject a 25 mg dose of propofol, which would provide an hour of sleep (unconsciousness) before going home. This use pattern resulted in at least 3 car accidents. One of these accidents occurred in an amnesic state; she awoke later in a completely unfamiliar part of town. She had totaled her car, but she somehow managed to get home without being caught. Several days later, her unsuspecting husband found her on the floor having fallen out of bed due to propofol sedation. Despite this, she somehow drove to work but was found slumped over her steering wheel by coworkers before her shift in the

hospital parking lot; she had used in the car before her shift. Her admission occurred promptly after this event.

Regarding drug use patterns, the analysis of the other drugs used by the subjects in this study was unremarkable in most areas. Propofol patients abused the same spectrum of substances typically abused by anesthesia personnel, including fentanyl and its congeners, benzodiazepines, hypnotics, marijuana, and cocaine. Tobacco use was also quite similar to the general HCP population at 36%.

In sharp contrast, the numbers of patients in the propofol group that reported alcohol as their primary drug of abuse was quite low (9%). The significance of this is unclear. The vast majority (82%) of individuals in the propofol cohort came from families with a history of substance dependence. One could speculate that the high rate of childhood trauma and substance use (primarily alcohol) in one's family of origin would result in a reactive avoidance of alcohol in the propofol-using group. Further investigation is needed here.

Our results underscore that propofol use induces a rapid downhill course. The median time from first use until entry into treatment was 2 months; 68% of all cases appear in treatment within 4 months of initial use. Propofol users also quickly lose control over their urges to use. This leads to poor judgment about where and when to use. Strikingly risky behaviors result from this loss of control. When evaluating case histories, a significant loss of judgment was observed as propofol abuse progressed.

In one example, a 58-year-old anesthesiologist began using propofol at home nightly for sleep induction. This began abruptly after a 10-year period of remission from alcohol dependence. Her initial use started with a single bedtime dose of 3.5 mL (35 mg) and rapidly escalated to where her first use was early in the evening with subsequent doses of 3 to 4 mL (30–40 mg), 2 to 4 times before retiring for the night. One day while at work, she experienced cravings for propofol and injected herself at the end of a case while still in the operating room. She was found unconscious and referred to treatment that day. This was 3 weeks from her first propofol injection.

Diagnosis and Comorbid Conditions

Propofol abusers readily endorsed *DSM-IV* criteria; the propofol-dependent group endorsed Criteria 3, 4, 5, 6, and 7 in nearly every case. The tolerance criterion (*DSM-IV* Criterion 1) was met half of the time, despite the fact that, in a large number of cases, the use period was quite short. One might be tempted to attribute a patient's precipitous fall from casual to out-of-control use to propofol's anesthetic-induction properties and its steep dose-response curve. The broad endorsement of the *DSM-IV* dependence criteria asserts that this is not the only reason behind this phenomenon. A more exacting interpretation of the case data suggests propofol produces dramatic effects and is highly addictive.

Schizophrenia diagnoses were absent in our propofol sample. This is similar to findings for all HCPs who present with substance use disorders (Earley, 2009). However, our small cohort seemed to have an unusually high number of individuals with a family history of schizophrenia (18%, statistical relation with the HCP Database was not possible). Such a high

rate of familial schizophrenia is unusual on face value. This finding needs replication with a larger sample. Its significance in the phenomenon of propofol dependence is unclear.

Females were more commonly propofol dependent when compared with the general health care population admitted to the center during the same time. This information, when combined with the high incidence of depression and trauma, presents a diagnostic tetrad (propofol use, female gender, depression, and past trauma). Prudent evaluators should carefully inquire about other potential elements of the tetrad (eg, early life trauma) when a HCP presents with the other 3 (eg, female HCP with propofol use and depression).

The exact relationship between childhood abuse and substance dependence is unclear; however, clinical and research data consistently point to a significant linkage (Khoury et al., 2010; Gielen et al., 2012). Rates of earlier emotional, physical, and sexual trauma seem to be higher in women and are one predictor of higher rates of relapse (Norman et al., 2007; Heffner et al., 2011). The relative risk for suicide and accidental fatal overdose among childhood sexual abuse victims has been reported at 18.09 (Cutajar et al., 2010). One is tempted to bring forth several psychodynamic analyses regarding the substance-dependent individual who presents with the tetrad of symptoms mentioned earlier. Propofol use allows one to “go unconscious,” forgetting the psychological anguish that results from depression or abuse. In another sense, propofol use is short-term self-annihilation, a short-term solution to intrapsychic pain. As tempting as such formulations are to us as therapists, such analyses and explorations only prove to be helpful once the patient has a sustained and stable recovery. The first order of business is addressing the addictive disorder and its comorbid conditions, ensuring they are in solid remission before venturing into psychotherapy aimed at uncovering suppressed or repressed trauma. In contrast, we have worked with cases where acknowledging the self-annihilative aspects of the propofol use produces meaning for, and improves therapeutic alignment with, our propofol patients. We posit that comprehensive, long-term treatment of comorbid depressive disorders and properly timed childhood trauma therapy is essential to interrupting the life-threatening relapses described in these cases.

One remarkable case is that of a 48-year-old male anesthesiologist with multifocal childhood trauma. He was sexually abused by a teacher at the age of 11 years, witnessed routine physical abuse of his mother by his stepfather, and he was present when his grandfather nonfatally shot his stepfather. His sexual trauma left him with conflicts about his sexual desires and orientation. He was raised in a fundamentalist religion and rarely used alcohol. When he started using drugs, propofol quickly became his drug of choice. His pattern was to inject small, frequent amounts of propofol at home, hoping to attain sedation and relaxation. Instead, he quickly noted characteristic dependence features, notably multiple attempts to control his use, increasing tolerance, anxiety, and diaphoresis upon withdrawal and continued use despite significant consequences. He relapsed 6 days after discharge from his initial 3-month residential treatment. Two hours after drug use, he was involved in a motor vehicle accident that resulted in open tibia/fibula

fracture. He relapsed a second time 1 year later and was immediately detected when he called the hospital with slurred speech. A year subsequent to his second relapse, he was allowed to return to work, but within 5 months, he had relapsed again and was found unconscious after a propofol overdose. After his third relapse, he was not permitted to return to anesthesiology.

Treatment and Workplace Issues

Operating room personnel (anesthesiologists and CRNAs) were the vast number of patients who reported propofol use. The overwhelming majority (20 of the 22 cases) had high access; the other 2 cases had easy propofol access. This study agrees with Wischmeyer et al (2007), who postulated that the probability of propofol abuse in HCPs is related to ease of access to the drug in the health care setting.

The data about professional access should not lead one to conclude that the single solution to propofol addiction is to eliminate easy propofol access in the health care environment. When combined with the ready endorsement of multiple addiction criteria and rapid downhill course noted earlier, propofol addiction is a virulent and debilitating form of substance dependence. Limiting access might decrease the numbers of individuals who experiment with propofol. History has shown, however, that substance dependent HCPs are quite resourceful in obtaining drugs whose access is already carefully controlled (eg, fentanyl). Once addicted, anesthesia personnel abuse many drugs (Earley, 2009). The resourceful but drug-dependent HCP would find ways of working around access limitations for any drug, including propofol. Instead, a multi-lateral approach to substance abuse in the operating room may be needed; a combination of preventative education, early intervention, aggressive treatment, and control of drug access is the best course in stemming the rising tide of propofol abuse.

What is the correct course of treatment for propofol-abusing HCPs who wind up in treatment after a single episode of propofol use? Such episodes commonly involve multiple injections of the drug during that binge. This single-binge episode, followed by an entry into treatment was not rare; it occurred in 18% of patients in our propofol group. Such individuals clearly have not been using for the length of time commonly associated with dependence or addiction. In some cases, the decision is easy, as the propofol use was the last of many substances used over a longer addiction career. These individuals earned their substance-dependence diagnosis before propofol and thus require treatment as with any other substance.

Individuals with no prior substance history, who later have a brief “Dance with the White Rabbit” (Ward, 2008), prove to be the most vexing. Should they embrace a model of total and life-long abstinence to all potentially addicting substances? Should they retrain in another field? Although extended treatment and lifelong abstinence may at times seem like overkill with these particular short-timers, providing no treatment is commonly associated with a fatal outcome (Drummer, 1992; Chao et al., 1994; Iwersen-Bergmann et al., 2001; Roussin et al., 2006; Kranioti et al., 2007; Kirby et al., 2009; Klausz et al., 2009; Lee and Yoo, 2009; Yoo, 2009). Taken in total, these cases suggest that addiction treatment

in such cases should include a focus on comorbid conditions and trauma resolution (if present), layered on top of traditional addiction care. “Drug refusal skills” that are tailored to professionals who have daily, work-related access to potentially life-threatening substances are indicated.

Thus far, nothing has been said about the safety of returning to work in a high propofol access position. Advocates line up on both sides of this discussion, often asserting that those on the other side are either “cruel” or have “lost their mind.” The literature review creates a confusing and contradictory picture. The clinical experience with these cases emphasizes the importance of an intense and sustained initial treatment coupled with long-term monitoring and judicious but aggressive medication management of any depressive illness and psychotherapy. Regarding return to work, clinical judgment is the only currently available and, by default, best tool.

This study did not allow follow-up after treatment. Because of the dramatic nature of propofol overdoses, there is a tendency for clinicians to see propofol dependence as a condition best treated by terminating a career. Additional research, focused on treatment outcomes in this population is sorely needed.

Limitations

The Propofol Database was built using a focused review of medical records. Unfortunately, the HCP Database contained analogous information for only 5 variables: gender, age at presentation, alcohol as a drug of choice, medical education, and medical specialty. Thus, findings *other* than these 5 should be considered as suggestive. Further studies are needed to evaluate the significance of other important findings of this study, including incidence of the following:

1. Significant physical injury directly due to intoxication
2. Unipolar depressive illness in the patient
3. Addictive illness in the biological family
4. Unipolar depression in the biological family
5. Childhood trauma

The question asked of patients as to the “reason” propofol was initially used is obviously subject to retrospective bias. Last, because the number of cases in the Propofol Database was limited, conclusions about propofol abuse should be considered preliminary.

CONCLUSIONS

Propofol dependence is a rapidly progressive form of substance dependence seen in 1.6% of all health care addiction cases reporting to treatment. This study suggests the incidence and/or detection rate of propofol abuse in HCPs is increasing. It occurs more commonly in women (when compared with the gender of all HCPs). Anesthesia personnel accounted for the vast majority of propofol cases. Propofol-related self-injury is striking with propofol abuse.

Careful screening of HCPs who present with a substance use disorder should include questions about propofol use. This is especially true in HCPs with ready access to propofol. Propofol abusers commonly have a history of depression and earlier life trauma; this is clinically important when establishing the initial and continuing care plans. If propofol is part of the use

pattern of a substance-dependent HCP, treatment providers should screen and aggressively treat a diagnosed depressive illness and the sequelae of childhood trauma. The time from initial use entry into treatment is often contracted when compared with other drugs of abuse, making the diagnosis of a true dependence disorder problematic in some cases.

Because of the lack of follow-up information, this study could not draw any new conclusions regarding propofol safety. Outcome studies with propofol-abusing HCPs are needed to help solve the difficult decisions of *when* and *whether* a propofol-abusing HCP should return to their high-risk work environment.

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