■ REVIEW ARTICLES

Addiction and Substance Abuse in Anesthesiology

Ethan O. Bryson, M.D.,* Jeffrey H. Silverstein, M.D.†

Despite substantial advances in our understanding of addiction and the technology and therapeutic approaches used to fight this disease, addiction still remains a major issue in the anesthesia workplace, and outcomes have not appreciably changed. Although alcoholism and other forms of impairment, such as addiction to other substances and mental illness, impact anesthesiologists at rates similar to those in other professions, as recently as 2005, the drug of choice for anesthesiologists entering treatment was still an opioid. There exists a considerable association between chemical dependence and other psychopathology, and successful treatment for addiction is less likely when comorbid psychopathology is not treated. Individuals under evaluation or treatment for substance abuse should have an evaluation with subsequent management of comorbid psychiatric conditions. Participation in self-help groups is still considered a vital component in the therapy of the impaired physician, along with regular monitoring if the anesthesiologist wishes to attempt reentry into clinical practice.

FIFTEEN years after the original article, "Opioid Addiction in Anesthesiology,"[1] was published, addiction still remains a major issue in the anesthesia workplace. Between 1991 and 2001, 80% of US anesthesiology residency programs reported experience with impaired residents, and 19% reported at least one pretreatment fatality.[2] Substantial advances have occurred in our understanding of addiction as well as both the technology and therapeutic approaches used to fight this disease, although outcomes have not appreciably changed. Starting with a brief review of the basic concepts of addiction, this article highlights the current thoughts regarding the pathophysiologic basis of addiction, as well as clinical manifestations, legal issues, and treatment strategies.

Anesthesiologists (as well as any physician) may suffer from addiction to any number of substances, though addiction to opioids remains the most common. As recently as 2005, the drug of choice for anesthesiologists entering treatment was an opioid, with fentanyl and sufentanil topping the list.[3] Other agents, such as propofol, ketamine, sodium thiopental, lidocaine, nitrous oxide, and the potent volatile anesthetics, are less frequently abused but have documented abuse potential.[4] Alcoholism and other forms of impairment impact anesthesiologists at rates similar to those in other professions.[5] Factors that have been proposed to explain the high incidence of drug abuse among anesthesiologists include the proximity to large quantities of highly addictive drugs, the relative ease of diverting particularly small quantities of these agents for personal use, the high-stress environment in which anesthesiologists work, and exposure in the workplace that sensitizes the reward pathways in the brain and thus promotes substance abuse.[6]

It is not the purpose of this article to present a manual for the treatment of addiction. Treatment should be administered by qualified personnel. All anesthesia personnel, however, should be aware of the basic nature of the problem and possess the necessary information to recognize and assist an impaired colleague.

◇ This article is featured in "This Month in Anesthesiology." Please see this issue of ANESTHESIOLOGY, page 9A.

◆ This article is accompanied by an Editorial View. Please see: Berge KH, Seppala MD, Lanier WL: The anesthesiology community's approach to opioid- and anesthetic-abusing personnel: Time to change course. ANESTHESIOLOGY 2008; 109:762–4.

🌐 Additional material related to this article can be found on the ANESTHESIOLOGY Web site. Go to http://www.anesthesiology.org, click on Enhancements Index, and then scroll down to find the appropriate article and link. Supplementary material can also be accessed on the Web by clicking on the "ArticlePlus" link either in the Table of Contents or at the top of the Abstract or HTML version of the article.

Prevalence

There are limited data available to determine the current prevalence of drug use by anesthesia personnel. Records of disciplinary actions, mortality statistics, and registries for known addicts provide some information, but it is difficult to interpret these types of data in that there is no guarantee that all cases are reported and the total population out of which the reports emanate is rarely available. In the past, it had been concluded that the true prevalence of addiction in physicians is un-

known,[7] though it had been suggested that drug abuse is at least as prevalent as among the general population.[8]

A review of 1,000 treated physicians conducted by Talbott *et al.*[9] in 1987 suggested that addiction is common among anesthesiologists. Anesthesia residents represented 33.7% of all residents presenting for treatment but composed only 4.6% of all US resident physicians at the time of the study, thus presenting an apparent 7.4-fold increased prevalence of anesthesia residents in the study population.[1] Subsequent studies have consistently differed from the results of Talbott *et al.* Five years later, a study by Hughes *et al.*[5] found the rate of substance abuse in the anesthesia resident population to be no higher than that of other specialties. Interestingly, this same study showed higher rates of substance abuse among emergency medicine and psychiatry residents. In 2000, Alexander *et al.*[10] published a study examining the cause-specific mortality risks of anesthesiologists that suggested that the risk of drug-related death among anesthesiologists is highest in the first 5 yr after medical school graduation, and remains increased over that of other physicians. Most recently, a survey conducted in 2002 by Booth *et al.*[11] found the incidence of known drug abuse among anesthesia personnel to be 1.0% among faculty members and 1.6% among residents.

Etiology

In 1956, the American Medical Association declared alcoholism to be an illness,[12] and in 1987, it extended the declaration to include dependence on all drugs. There have been many theories regarding the etiology of chemical dependence,[13] including biochemical, genetic, psychiatric, and, more recently, exposure-related theories.[6] None alone has been able to identify specific causes, only to suggest what may increase the risk of developing addiction among anesthesia personnel.

Genetic and Biochemical Theories

Considerable research done in mice suggests a genetic basis for addiction. Tapper *et al.*[14] engineered mutant mice with α_4 nicotinic subunits that contained a single point mutation, Leu9′ → Ala9′, in the pore-forming M2 domain. The resulting nicotinic acetylcholine receptors were hypersensitive to nicotine, with the mutant mice exhibiting reinforcement in response to acute low-dose nicotine administration. It is this exaggerated response to lower levels of stimuli that is thought to be important in the development of dependence in susceptible individuals. Tolerance and sensitization elicited by chronic nicotine administration were also observed, suggesting the possibility that behaviors associated with the use of drugs of abuse may be reinforced by much smaller doses in some persons who are genetically susceptible but not in others who do not share this genetic predisposition.

There is strong evidence to suggest that drugs of abuse that activate the reward structures in the brain induce lasting changes in behavior that reflect changes in neuron physiology and biochemistry.[15] Although the majority of individuals who experiment with psychoactive substances do not become dependent, there exists a subset of individuals who do. These individuals typically exhibit preexisting comorbid traits such as novelty-seeking and antisocial behavior, and there seems to be a genetic basis for both the susceptibility to dependence and these comorbid traits.[16] According to one recent study, this genetic susceptibility plays a role in the transition from substance use to dependence and from chronic use to addiction.[17] Many genes have been identified as possibly playing a role in the susceptibility to drug addiction, but as of this publication, investigators have been able to identify a functional mechanism related to the specific effects of abused drugs in only a few.[18]

Release of the neurotransmitter dopamine in the mesolimbic system of the brain is involved with the reinforcement of drug-seeking behaviors associated with several drugs of abuse, including nicotine. Picciotto *et al.*[19] reported on mice lacking the β_2 subunit of the high-affinity neuronal nicotinic acetylcholine receptor. They found that mesencephalic dopaminergic neurons from mice without the β_2 subunit did not respond to nicotine, as did neurons from wild-type mice. The self-administration of nicotine was observed to be attenuated in these mutant mice.

In humans, the cholinergic muscarinic 2 receptor has been associated with the function of memory and cognition. Wang *et al.*[20] reported that variation in the gene responsible for the production of this receptor predisposed to both alcohol dependence and major depressive syndrome. Luo *et al.*[21] looked at the relations between the variations in the cholinergic muscarinic 2 receptor gene and alcohol dependence, drug dependence, and affective disorders in a population of 871 subjects and identified specific alleles, genotypes, haplotypes, and diplotypes significantly associated with risk for either dependence or affective disorders. Because there is empirical evidence that the disorders of substance abuse are prevalent within multiple generations of some families, it makes sense that there should be some associated genetic component. How much of a role this component plays in the development of the disease is not yet known, because there are many factors that contribute to the development of a substance use disorder in a predisposed individual.

Psychiatric Comorbid Conditions

There is considerable association between chemical dependence and other psychopathology. A 1991 review of the data found personality disorders in 57 of 100 substance abusers.[22] Of physicians admitted to one in-

patient drug/alcohol treatment facility in 1984, 5.9% had a primary psychiatric diagnosis as well as chemical dependence.[23] Therefore, it has been suggested that one source of motivation for the self-administration of drugs of abuse is the self-medication of symptoms associated with comorbid psychiatric disorders.[24] The observation that individuals with the same personality traits tend to self-administer drugs from the same class, *i.e.*, opioids for anxiety and depression and amphetamines for attention deficit and hyperactivity states, lends credence to this theory. Individuals under evaluation for or treatment for substance abuse should have an evaluation with subsequent management of comorbid psychiatric conditions.

Exposure-related Theories

It has been suggested that emotional stress and access to agents may play much less of a role in the development of addiction than was previously thought. Gold *et al.*[6] presented the hypothesis that the increased risk of addiction in certain occupational settings, such as within the practice of anesthesiology, is related to exposures that sensitize the reward pathways in the brain to promote substance use. It is known that drugs of abuse physically alter the chemistry of the addicted brain, changing the relative levels of the neurotransmitters γ-aminobutyric acid, dopamine, and serotonin associated with reward pathways such that drug-seeking behavior is favored over the rational evaluation of the risks of such actions.[25-27]

Gold *et al.* suggest that anesthesiologists who become addicted through such sensitization in the workplace may continue to use the agents to alleviate the withdrawal they feel when away from the exposure. The evidence to suggest this mechanism of addiction is based on the observation that low doses of opiate drugs can induce sensitization, and these agents are present and measurable in the exhaled breath of patients receiving them.[28] However, these chemical changes result from levels of exposure typically associated with active use of drugs of abuse and not from the trace levels found in the work environment, and it is not made clear how the transition to active use of these agents occurs. This is certainly a novel and relatively new idea, and considerable research needs to be conducted in this area before any conclusions can be made regarding its validity.

Clinical Manifestations

Although not one of the specific criteria for diagnosis of drug-related disorders, denial can present a major obstacle to treatment of the addicted physician.[29] The addict does not recognize that he or she has a problem, and treatment is seldom spontaneously sought. Denial is not lessened by education and training, and some have even suggested that physicians and other highly educated and highly functioning addicts may have a well-developed denial mechanism in place.[29] Physician–patients are often described as having grandiose ideas of invulnerability and self-sufficiency, and as unable to accept that abuse leads to addiction and that addiction is loss of autonomy.[30]

Denial is not limited to the addict.[1] Coworkers, friends, relatives, and associates will often make excuses for or prefer not to deal with the impaired physician.[31] It can be difficult to accept that a problem in a colleague is a result of addiction, but failure to initiate an investigation because of "uncertainty" masked as concern for the individual is denial.

Behavior Patterns

Because of the unique proximity of the chemically dependent anesthesiologist to his or her drug of choice while at work, behaviors that would arouse suspicion in another setting may make the addicted physician seem quite functional. The addicted anesthesiologist becomes extraordinarily attentive at work as maintaining a job in close proximity to the source of drugs becomes more important than aspects of the individual's personal life. Changes in behavior are frequently noted, with periods of irritability, anger, euphoria, and depression common.

Often it is the individual with this disorder who is the last to recognize that a problem exists. It is therefore imperative that those people most likely to observe the signs and symptoms of addiction, *i.e.*, the relatives, friends, and coworkers, gain a clear understanding of the disease and understand what to do if they suspect someone may have a problem. Early identification of the affected individual can often prevent harm, both to the impaired physician and to his or her patients. Early detection is often difficult because of the compartmentalized relationships the individual may have with different members of their social structure. The spouse of an addict may observe behavioral changes that may pass unnoticed by colleagues at work, and the entire picture is seldom appreciated by any one person.

Some of the changes typically observed in the affected anesthesiologist include but are not limited to the following[32]:

· Withdrawal from family, friends, and leisure activities
· Mood swings, with periods of depression alternating with periods of euphoria
· Increased episodes of anger, irritability, and hostility
· Spending more time at the hospital, even when off duty
· Volunteering for extra call
· Refusing relief for lunch or coffee breaks
· Requesting frequent bathroom breaks
· Signing out increasing amounts of narcotics or quantities inappropriate for the given case
· Weight loss and pale skin

The period of time over which these changes are manifested depends on the drug to which the individ-

ual has become addicted. Alcohol addiction typically takes years to become apparent, whereas addiction to the short-acting opioids, fentanyl and especially sufentanil, becomes apparent over the course of a few months of use.

So powerful is the disease of addiction and the need for the drug that otherwise reasonable and intelligent people will resort to seemingly incredulous behavior to obtain their drug of choice. Addicts may chart the use of an agent when in fact either an alternate agent or none at all was administered. Entire cases may be done with inhalational agents and β-blockers and charted as opioid based. Addicts may substitute a syringe containing their drug of choice for one containing saline or a mixture of lidocaine and esmolol during a relief break. Some have admitted to rummaging through sharps containers looking for residual drug in discarded syringes. Addicts quickly become proficient at removing controlled substances from secure places. The security features of automated dispensing machines are easily defeated, and drugs may be removed from glass ampules and replaced with another liquid without evidence of tampering.

Depending on the half-life of the abused agent, tolerance can develop rapidly. It is not uncommon for the addict in recovery to report self-administration of 1,000 μg fentanyl in a single injection, often simply to relieve the symptoms of withdrawal. When looking over the records of an addicted anesthesiologist, an increase in the quantity of opioids requested, particularly on Fridays, can often be noted.

Legal Issues

When dealing with an addicted physician, there are a number of legal issues to consider. The physician who is reported to either the state board of medicine or a physician referral program faces a series of legal choices. Consultation with legal counsel in these matters is mandatory for both the reported physician and the institution involved with reporting the physician, because an individual's license to practice medicine is in jeopardy.[1] As well, failure to report an impaired colleague may be considered negligence and leaves the individuals and institutions involved open to questions of liability should harm come to any patient. It is important to note that the legal requirements and protections associated with physician impairment are different from state to state. This is particularly true for confidentiality of records and the relation of Impaired Physicians Programs to licensure boards.[1] This section explores these issues but should not be construed as legal advice.

Diversion/Impaired Physicians Programs

The medical licensing board of each state may suspend or revoke an individual's license to practice medicine. In addition to actions against licensure, state, local, and federal authorities may institute criminal action associated with an individual's actions, including charges for diversion of controlled substances. As an alternative to suspension or revocation, state medical societies are allowed, under certain circumstances, to enroll physician addicts into diversion programs designed to rehabilitate the affected physician and return him or her to the practice of medicine. Enrollment in these programs is "voluntary," though nonparticipation almost always results in the case being turned over to the state licensing board. Although the licensing agencies are generally reluctant to accept any diminution of authority, they recognize that professional societies are more easily able to engage impaired colleagues. Many state Impaired Physicians Programs have now negotiated a significant responsibility for the investigation, intervention, and diversion in reported cases of impairment.[33-35]

In this instance, diversion is defined as the process of intervening in the case of a physician or nurse and arranging for assessment, treatment, and potentially return to practice independent of licensure authorities. The potential for involving licensure authorities represents the coercive power of diversion programs.[1] The relation between an Impaired Physicians Program and its associated licensing board is highly variable from state to state, and subject to constant reassessment.[36]

Although the issue of board certification is somewhat separated from that of medical licensure, it is the policy of the American Board of Anesthesiology (ABA) that a physician must maintain a permanent, unconditional, and unrestricted license to practice medicine in at least one state in the United States to maintain board certification. The ABA recently clarified its position on revocation of ABA certification for physicians involved in diversion programs in a recent issue of *ABA News*. According to the article, "It is the policy of the ABA that participation in an approved treatment plan for impaired physicians is not considered a restriction on a medical license in and of itself. If a state medical licensing board permits the practice of medicine while a physician is compliant with an approved rehabilitation plan, the ABA will allow certification to be maintained."[37]

State medical society diversion programs are available to provide consultation concerning intervention strategies, state-specific legal considerations, and reporting requirements. Some Impaired Physicians Programs sponsor group-therapy sessions for recovering health professionals.[1] Impaired Physicians Programs can be a great information resource, providing listings of available self-help groups, therapists, treatment centers, sources of legal advice, and urine monitoring programs.

Additional information regarding the state society programs that assist impaired physicians and nurses, including contact information and Web site addresses,

is available on the ANESTHESIOLOGY Web site at http://www.anesthesiology.org.

Confidentiality

Once involved in treatment, physicians are expected to share their experiences with addiction and substance abuse openly with peers and therapists through group therapy and participation in anonymous self-help groups such as Alcoholics Anonymous (AA) or Narcotics Anonymous (NA). In 1996, Roback *et al.*[38] examined the confidentiality dilemmas that exist in group psychotherapy with recovering physicians and found that because of the risk of personal and professional harm, participants remained exceedingly concerned about breaches of confidentiality. Because the current law provides little protection to physicians who enter group therapy, perhaps improving legislation would result in greater or more honest disclosure in the group setting.

Mandatory Reporting and Immunity

Failure to report an impaired physician as required by law may result in disciplinary action against the institution or designated individual.[1] Many of these laws provide immunity for persons who report an impaired professional; however, some specifically do not. Each state has its own laws regarding mandatory reporting and immunity.[39] For example, under Colorado law, addiction to alcohol or drugs is classified as unprofessional conduct, which therefore must be reported to the licensing board.[40] Under most circumstances, the individual making such a report is immune from civil suit over this action so long as it is made in good faith. There are reporting exceptions for the treating physician of the addicted physician–patient, so long as the physician–patient is not a danger to his or her patients.

The National Practitioner Data Bank functions as a repository for information regarding professional conduct, licensure status, and malpractice claims of the nation's physicians.[1] Voluntary entry into a substance abuse treatment program is not reportable to the National Practitioner Data Bank. As well, voluntary surrender of a medical license during treatment may not require reporting, but suspension of a physician's clinical privileges (*e.g.*, by a hospital) for greater than 30 days does.[1] Individuals wishing to make such a report should be familiar with the laws in their state of practice.

The Americans with Disabilities Act

The Americans with Disabilities Act, enacted in 1992, offers some protections to the addicted physician, though it should be noted that the protections offered by the Americans with Disabilities Act are limited in scope and are applied differently to individuals who are dependent on alcohol *versus* illegal drugs.‡ No protection is afforded to the user of substances other than alcohol unless he or she is currently in a treatment program, whereas the alcohol-dependent person need not be in treatment to be protected under this act. Recent case law has reduced these limited protections afforded by the Americans with Disabilities Act to addicted persons.[41] The Contract with America Advancement Act of 1996 removed substance use disorders as a valid cause of disabling impairment. If the addictive disorder exists in the presence of other psychiatric or medical disorders, the individual may qualify for protection if the individual would remain disabled if he or she stopped using alcohol or drugs.[42] As well, the presence of a substance-related disorder will not, by itself, allow an individual to collect disability benefits under the Veterans Administration unless another psychiatric or medical condition is also present, because of the determination by the US Supreme Court that a alcoholism involves an act of willful misconduct, which violates Veterans Administration regulations.[43]

To the extent that these regulations apply to the anesthesiologist in recovery, it should be understood that relapse presents a significant clinical risk and danger. The first symptom of relapse in an extraordinarily high number of cases involving the return of a fentanyl-addicted anesthesiologist to the operating room anesthesia practice has been death.[44] We may define disability as being unable to perform all or some aspects of a specific job, such as those required of an anesthesiologist, because the individual is disabled by active addiction, the need to receive treatment, or the need to pursue time-intensive recovery activities that may preclude work. Disability related to the potential for relapse, or a "prophylactic" disability, which is a very real concern when the anesthesiologist in recovery returns to the clinical practice of anesthesia, is generally not covered.[39]

Diagnosis and Treatment

An addiction psychiatrist should direct diagnosis and treatment. In 1993, addictionology was a relatively new specialty, with addiction psychiatry formally recognized by the American Board of Medical Specialists in 1992. The American Board of Psychiatry and Neurology began offering added qualifications in addiction psychiatry in 1993 and, although not recognized by the American Board of Medical Specialties at the time, the American Society of Addiction Medicine established a credentialing and examination process for its members. Currently, the American Board of Psychiatry and Neurology recognizes addiction psychiatry as a subspecialty of psychiatry that focuses on evaluation and treatment of individuals

---

‡ Further information regarding the implications of the Americans with Disabilities Act may be obtained from the Civil Rights Division of the US Department of Justice, Washington, D.C., at: http://www.usdoj.gov/crt/. Accessed June 22, 2008.

with alcohol, drug, or other substance-related disorders and of individuals with dual diagnosis of substance-related and other psychiatric disorders. An addiction psychiatrist referral may be obtained from drug treatment centers, the American Society of Addiction Medicine, or state Impaired Physicians Programs.

Initial Therapeutic Period

Once it has been established that a physician is impaired and requires treatment for addiction, a referral is made to an inpatient facility that specializes in the treatment of physicians. It is important that such a facility is chosen so that the affected individual may develop the support of other similarly affected physicians.[45] Although there are currently no programs in the United States that admit only physicians, several are available that offer programs for physicians and other medical personnel within the larger inpatient population. These groups interact with each other during activities that involve the entire population, such as recreational therapy and 12-step study groups, though group therapy sessions are structured so that the members of the medical professionals population are separated from the general population. The disease of addiction is one of isolation, and treatment in a facility where the other patients are not physicians or healthcare professionals may lead to an increased sense of isolation and despair.[46] As well, such an environment may foster the false belief that the physician is a special case, different from the other patients, and such treatment is detrimental to the individual's recovery. It is important that the physician see peers in the same situation, going through the same treatment.

Most treatment centers are based on the Minnesota treatment model,[47] which is derived from the recovery model of AA. Treatment involves detoxification, monitored abstinence, intensive education, exposure to self-help groups, and psychotherapy. Various models of individual and group therapy all aim at altering key addictive behaviors.[48] Inpatient therapy is an intensive form of treatment, with staff contact extending up to 12 h per day, 7 days per week. In this setting, patients are removed from the stresses of daily life and from access to alcohol and drugs. Typical inpatient durations of stay are between 8 and 12 weeks, but may be as long as 6 to 12 months if it is determined by the treatment team that the patient is not ready for discharge.

Anesthesiologists who are abusing opioids or other anesthetic agents are commonly sent for residential treatment that may last from 2 months to a year or more. The duration of treatment required and the very real possibility that little, if any, of the costs of treatment will be covered by medical insurance can be financially devastating to the physician in early recovery, because most residential treatment centers charge from $3,000 to $4,500 per week for treatment. In one recent survey that examined the level of satisfaction of impaired healthcare professionals with mandatory treatment and monitoring, 40% of Michigan respondents and 53% of Indiana respondents did not have insurance coverage for program costs.[49] The Impaired Professionals Committee should have a basic understanding of what mental health coverage is engendered by their health insurance coverage.

Subsequent Therapeutic Modalities

The intention of the initial period is to lay the groundwork for long-term abstinence and recovery. After successful completion of the inpatient treatment program, the individual is discharged either to a halfway house or directly to the community, where the work of early recovery begins. A structured halfway house community, with 60–120 h per week of staff contact, is often recommended for a 4- to 8-week period. Outpatient therapy may be appropriate under certain conditions. Outpatients must be able to function in their normal daily environment and are expected to remain abstinent despite normal availability of alcohol and drugs. It is our opinion that the chemically impaired anesthesiologist is best initially treated in an inpatient setting.

Most states allow physicians to return to work after inpatient treatment so long as these physicians remain under the supervision of a physician health and well-being organization, such as those sponsored by the state medical society. Monitoring contracts are usually a minimum of 5 yr in duration and include regular contact with a caseworker at the monitoring organization, worksite observation, and random urine drug and alcohol screens. The mainstay of long-term treatment is the complete abstinence from all mood-altering drugs, facilitated group psychotherapy with other recovering physicians, and regular attendance and participation in self-help fellowships such as AA or NA.[49] Concerns specific to reentry to the anesthesia work environment are discussed in detail below.

Abstinence Monitoring

Urine testing is still the cornerstone for monitoring and documenting abstinence in the recovering addict.[50] The value of urine testing as a therapeutic tool has not been clarified, though it is commonly thought to have a deterrent effect on drug use. Details of urine testing and new modalities currently under investigation are described in a subsequent section.

Compliance with mandatory urine monitoring schedules, which must be paid for out of pocket by the individual, may be difficult when financial issues are present. The cost for collection by an approved monitor and processing of urine or blood samples can be as much as $90 per sample and are often collected two or three times per week during early recovery. If the individual has a history of abuse of fentanyl, sufentanil, propofol, or any other drug that is not routinely included in the basic

Table 1. Side Effects Associated with the Use of Naltrexone

Abdominal pain/cramps	Headache
Anxiety	Impotence
Arthralgia	Irritability
Chills	Myalgia
Constipation	Nausea
Depression	Nervousness
Diarrhea	Rash
Dizziness	Sleep disturbances
Ejaculation disturbances	Vomiting

From Silverstein *et al.*[1]; reprinted with permission.

screen for drugs of abuse, the cost per sample to identify these agents is significantly increased.

Receptor Antagonists

Naltrexone, like naloxone, is a relatively pure μ-receptor antagonist. In contrast to naloxone, naltrexone is highly effective orally and still remains part of the treatment for anesthesiologists returning to the operating room. Recent studies suggest that naltrexone may reduce the cravings for both narcotics and alcohol in the recovering addict.[51] It produces sustained competitive antagonism of opioid agonists for as long as 24–48 h and is taken as either 50 mg daily or 100 mg three times per week. The antagonism may be overcome by large doses of opioids, which may result in immediate respiratory arrest. The blocking of agonist activity by an antagonist should be contrasted with the activity of a metabolic inhibitor, such as disulfiram (Antibuse; Wyeth-Ayerst, Philadelphia, PA), which blocks an enzyme in the pathway of alcohol metabolism, leading to the accumulation of a noxious metabolite.[52] Detoxification is mandatory before prescription of naltrexone, because ingestion without detoxification will precipitate a severe withdrawal syndrome. Significant side effects associated with the use of naltrexone are listed in table 1.

Self-help Groups

Participation in self-help groups is considered a vital component in the therapy of the impaired physician.[53] Self-help groups originated as a response to an unmet need for support and services available to those in recovery from addiction.[54] The AA 12-step program is the prototype organization serving as a model for NA and other self-help programs. Meetings of AA and NA are frequent and are available nationwide.

There are also organizations of recovering healthcare professionals based on the "Twelve Steps" and "Twelve Traditions" of AA but with membership limited to those in the healthcare professions. Local groups may be found by contacting the AA or NA or the state Impaired Physicians Program. International Doctors in AA serves as an umbrella organization for physician recovery groups around the world, and Anesthetists in Recovery is a similar group dedicated to recovering certified registered nurse anesthetists.

Professional Behavioral Observation

Once discharged from inpatient treatment, recovering physicians are often required to continue therapy with a certified addiction psychiatrist on a regular basis. Individual therapy may be more frequent initially, and later reduced to one or two office visits a month, designed to uncover behaviors and attitudes that can threaten ongoing recovery.[1]

Additional Psychotherapeutic Modalities

In addition to individual therapy, group therapy is often indicated for a protracted period of time. Designed to educate the individual and modify behavioral factors to support continued recovery,[55] weekly attendance at facilitated group therapy and individual psychotherapy is typically mandated for physicians in early recovery. It should be noted here that if the costs of these mandated sessions is not covered by insurance or if the physician has lost his or her medical coverage as a result of the loss of employment, these costs must be paid out of pocket by the individual in recovery. Inability to comply with mandated therapy and monitoring, even if due only to financial problems, can lead to removal of the physician from the monitoring program and the inability of the individual to reenter the clinical practice of medicine. The worst case would obviously be relapse into active addiction or death from an unintentional overdose.

Attention has been directed to the stresses peculiar to a medical family and to the role played by family members in impairment.[56] Fifteen years ago, this was still a developing subject in substance abuse therapy; involving the family of an impaired physician in the treatment process is now considered critical to the establishment of a support system for recovery.[57] Involving the family of an addicted individual allows for the development of an understanding of the disease concept of addiction, enabling, and has been shown to improve outcomes in the treatment process for addicted individuals.[58]

The Role of Ultrarapid Detoxification

Often the first step in treatment after intervention is detoxification of the individual. Most inpatient facilities admit patients first to a detoxification area, where they can be monitored for signs and symptoms of withdrawal and treated accordingly. This occurs over a period of days and often results in considerable suffering. As well, inpatient rehabilitation cannot begin until the patient is past the withdrawal period and able to focus their attention entirely on the work of recovery. Recently, newer techniques have been developed that dramatically accelerate the detoxification process, often doing so in less than 24 h.[59] Ultrarapid detoxification centers operate on the premise that continued opioid use results from the attempts to avoid withdrawal symptoms, and that elimination of these symptoms can ensure prevention of relapse. The rapid induction onto maintenance treat-

ment with opioid antagonists such as naltrexone is performed during general anesthesia, often in an outpatient setting.[60] Patients are simultaneously relieved of the physical symptoms of withdrawal and placed on opioid antagonist maintenance to prevent cravings and relapse, but little, if any, emphasis is placed on treating either the psychological issues or personal circumstances that resulted in addiction initially. The long-term success of this method has been shown to be no more effective than traditional methods of detoxification when the main outcome measure is the prevention of relapse.[61]

Prognosis

There remain few studies specifically examining the prognosis for continued recovery in the addicted anesthesiologist who returns to the clinical practice of anesthesiology, though the major controversy surrounding this decision surrounds the use of parenteral opioids and their availability in anesthesia practice. The studies available and the current thinking regarding reentry into anesthesiology are discussed in the following section.

Prospects for Reentry into Anesthesiology

Whether anesthesia personnel should be allowed to return to the operating room after successful treatment remains highly controversial. Historically, a distinction was made between the anesthesia resident and the attending. The thought was that the attending has fewer options and should be given a chance to reenter practice, whereas the resident should be encouraged to find another specialty. Too often, however, the attending who has successfully completed a short course of treatment is asked to return to work in the same full-time, stressful practice without any time allowed for early recovery work. The result is often disastrous. Residency programs, however, are more able to adsorb the part-time resident in early recovery, and this slow reentry into clinical practice may allow the motivated individual to pursue a career in anesthesia. The current thought is that the decision to allow an individual to return to the practice of clinical anesthesia should be made on a case-by-case basis, regardless of the level of training.

In the past it was thought that most anesthesiologists who completed therapy should be allowed to return to work. Historical data from the Impaired Physicians Program of the Medical Association of Georgia suggests that physicians who remain compliant with their prescribed program are able to remain abstinent at 2-yr follow-up.[62] However, because individuals lost to follow-up were not included in the evaluation, the majority of case failures were excluded before analysis.[1]

In 1990, a report of 180 cases of substance abuse by residents in anesthesiology concluded that prolonged abstinence was unusual and that redirection to another medical specialty is the desired course for an individual who abuses parenteral opioids.[44] This study queried directors of US anesthesiology training programs regarding the abuse of parenteral opioids and other drugs by their residents. Of the 180 reported cases, 13 (7%) presented as death per anoxic brain injury. Of the 167 remaining cases, 113 (67%) were allowed to reenter anesthesiology training. Those abusing opioids had only a 34% success rate reentering anesthesiology, and of the 66% who relapsed, 13 (25%) died as a result. Those abusing other drugs or alcohol had a 70% success rate, and of the 30% who did relapse, only 1 (13%) died. The authors defined success as an individual who underwent treatment, completed the residency, and had no relapse in practice to the best of the program director's knowledge.

Some have been critical of this study for a number of reasons, though the conclusions are likely valid. The conclusions are based on an incomplete survey of directors whose recall may be inaccurate.[63] As well, only 37% of the residents reviewed received more than 6 weeks of inpatient treatment, a figure considered inadequate by many experts in the field.[64] The authors also have been criticized for suggesting that residents be redirected to other specialties without evaluating the outcome of those who were.

In 2005, another report on the treatment outcomes of anesthesiology residents was published with very similar data. Collins *et al.*[65] conducted a survey of all US anesthesiology residency programs regarding experience and outcomes with chemically dependent residents from 1991 to 2001 and concluded that the redirection of residents who have successfully completed treatment into lower-risk specialties may allow a greater percentage to achieve successful medical careers. The majority of residents studied attempted reentry, but only 46% successfully completed an anesthesia residency. Of those residents who attempted reentry, the mortality rate was 9%.

Obviously, a mortality rate of 9% is unacceptable for any intervention; therefore, we do not advocate automatic reentry into anesthesiology for any residents, attending physicians, or certified registered nurse anesthetists. Rather, we agree with the idea that each case must be evaluated on an individual basis. Recent experience at our institution suggests that a graded reintroduction into the clinical practice of anesthesia may be no better at reducing the incidence of relapse than reintroduction after a short period of treatment.[66] Of note, this process of graded reintroduction may be beneficial insofar as the initial presenting event that marked the relapse of each individual was not death.

Implicit in this discussion of reentry is the potential for denying reentry into anesthesiology. If an addiction psychiatrist recommends that an individual should not return to the practice of anesthesiology, we believe that denial of reentry can be successfully

defended.[1] The case in which the addiction psychiatrist recommends reentry into anesthesia presents problems for denial of reentry. The Americans with Disabilities Act (section IIIE) has placed the onus of responsibility on the employer to prove that the employee is unable to perform the responsibilities of his occupation.[1]

Risk Factors for Relapse

Because of the nature of the disease of addiction, individuals who have successfully undergone treatment are still at risk for relapse. In a retrospective cohort study, Domino *et al.*[67] examined the rate of relapse among 292 physicians involved in the Washington Physicians Health Program between 1991 and 2001. Of the 2,922 individuals studied, 74 (25%) had at least one relapse. Factors that were associated with an increased risk of relapse included a family history of substance use disorder, the use of a major opioid, and the presence of a coexisting psychiatric disorder. Interestingly, the use of a major opioid increased the risk of relapse only in patients with a coexisting psychiatric disorder.

Work Reentry Contract

Anesthesiologists who are allowed to reenter medical practice must agree to certain conditions of reentry. A work reentry contract should be created outlining the individuals' responsibilities. Key to the success of such a contract is the open communication between all involved parties. The treating psychiatrist, members of the recovery support network, and persons responsible for verifying compliance with the work reentry contract need to maintain contact on a regular basis.

Some programs suggest that the first 3-month period of reentry to the operating room should exclude night and weekend calls and the handling of opioids. At the end of this period, the practitioner is reevaluated by treatment personnel. Our policy is to require a period of time, usually at least 1 yr, away from the practice of clinical anesthesia before reentry is attempted. This allows the individual time to concentrate on the work of early recovery and also to consider alternate career paths. The first year back in clinical practice is typically at two-thirds time, or no more than 40 h per week, with no call for the first 3 months.

The ABA has developed a specific policy regarding entry of individuals recovering from alcohol or drug addiction into their examination process. They currently have no written policy regarding diplomats of the ABA who are in recovery.[37]

Prevention

Clearly, the prevention of chemical dependence is preferable to treatment. Unfortunately, this remains a societal problem that is difficult, at best, to deal with.[45] Control of drug supply and education remain the mainstay of prevention, though one study suggests that the increased control and accounting procedures for controlled substances and increased mandatory education has not changed the frequency of controlled substance abuse among anesthesiologists.[11] Random drug screening for all anesthesia personnel remains a contentious issue, and as of 2002, only 8% of anesthesiology residency training programs used random urine testing, though 61% of departmental chairs indicated that they would approve of such a policy.[11] One survey of individuals involved in physician health programs reported a 39% incidence of substance abuse or mental health difficulties before a career in medicine,[68] suggesting that the use of substance abuse screening tools during interviews for medical school or residency may be helpful.

Drug Control

It has been suggested that a major contributing cause of addiction in anesthesiology is easy access to opioids and other psychoactive substances.[69,70] Even if access alone does not result in drug abuse, tighter control allows for earlier detection and documentation in suspected cases of abuse.[1]

A number of methods for control of opioids and other drugs in the operating room exist that involve careful record keeping and evaluation of use patterns.[71-74] Anesthesia information management systems have been successfully used to identify patterns suspicious for diversion among anesthesia personnel.[75] Computerized records may be examined to identify high use of opiates, high wastage of controlled substances, transactions that occur on cancelled cases or after case completion, and automated dispenser transactions that occur in a different location from the scheduled case. There is certainly an innocent explanation as to why any of these transactions suspicious for diversion activity may occur, and follow-up by monitoring personnel is required to determine whether diversion is an issue.

Computerized dispensing units are available for use, though in many institutions a satellite pharmacy dispenses controlled substances. At Mount Sinai, controlled substances are dispensed with a drug disposition form, and subsequently every anesthesia record is checked against the disposition record. Anesthesia personnel are asked to explain any discrepancy, and all discrepancies are reported to the departmental Impaired Professionals Committee. Because a computerized record-keeping system is in use at our institution, monthly reports regarding individual practitioners' use of controlled agents are generated, and outliers are identified. Such reports may be used to facilitate early intervention in cases of suspected diversion.

All waste drugs must be returned to the pharmacy, where they are analyzed on a random basis to verify

content. The Division of Quality Control, Department of Pharmacy of the Mount Sinai Medical Center has established the following policy for evaluating returned waste drugs. All undiluted returned drugs are analyzed by either refractometry or, for alkaloids (morphine, meperidine, fentanyl, cocaine, *etc.*), by precipitation with Mayer reagent. Diluted drugs are not detected by these methods and, in cases of repeated negative qualitative assay for any substance, quantitative analysis is requested from a forensic laboratory. Forensic laboratories are equipped for quantitative analysis of current anesthesia related psychoactive compounds, including fentanyl, sufentanil, and propofol.

Education

There continues to be an effort toward education of the anesthesiology community regarding substance abuse. Presumably, widespread education of the anesthesia community may aid in the early detection of afflicted colleagues. In 1991, between 47% and 89% of anesthesia programs had at least one lecture on substance abuse, but only 33% had an identifiable substance abuse program or committee.[76] By 2001, the number of hours of formal education regarding drug abuse had increased in 47% of programs,[11] but the rate of known substance abuse by anesthesiologists remains constant, at 1.0% among faculty members and 1.6% among resident physicians.[11] Whether education prevents addiction is not clear.

A number of educational videos are available that directly address the issue of substance abuse and anesthesia personnel and may be used as part of a program of education for residents training in anesthesiology. "Wearing Masks: The Potential for Drug Addiction in Anesthesia" was produced in 1993 and sponsored by the Association of Anesthesia Program Directors. The second video in this series, "Wearing Masks II," and the recently released third video, "Wearing Masks III," contain resource material for individuals concerned with addiction.§ The video "Unmasking Addiction: Chemical Dependency in Anesthesiology" was published in 1991 and is available from Janssen (Ortho-McNeil-Janssen Pharmaceuticals, Titusville, NJ).

Testing Methodologies

Urine Testing

When urine is tested as part of a rehabilitation toxicology program, a screening test is usually followed by a more specific confirmatory test because there is a high requirement for sensitivity to avoid a false-negative result. This section discusses current technical and forensic concerns associated with urine drug testing.[77-79]

---

§ These videos are available free of charge from the publisher and may be ordered at: http://www.allanesthesia.com. Accessed June 22, 2008.

The general drug screen composition varies from laboratory to laboratory. Certain drugs commonly abused by anesthesia personnel may or may not be included. Morphine, codeine, and meperidine are more commonly included, but fentanyl, sufentanil, alfentanil, and propofol are almost never part of a standard drug screen and must be specifically added to the assay (often at considerable additional expense) of each specimen. It is important to use a general drug screen because of the common abuse of multiple drugs, but specific requests should be noted if fentanyl, sufentanil, or propofol are to be included.

Familiarity with the available laboratory procedures allows for proper test selection and interpretation. Of the commonly available assays, thin-layer chromatography is the least sensitive and is generally performed as a screening test, whereas gas chromatography/magnetic resonance spectroscopy is considered the gold standard against which other methods are compared and by which any positive result should be confirmed.[80]

While some states may require that random drug screening programs guarantee privacy for employees while providing bodily fluids for drug testing, this degree of privacy does not apply to a documented case of substance abuse.

Witnessed collection is necessary to avoid a sham urine sample. Methods to circumvent detection include self-instillation of "clean" urine into the urinary bladder, either through catheterization or suprapubic injection, and the use of an artificial penis with a reservoir for clean urine, worn close to the skin and kept warm. Artificial urine is commercially available from multiple vendors *via* the Internet, and a number of teas, herbs, and extracts are marketed with the intent of allowing the user to "conquer" the urine drug tests.

Random observed urine collection is mandatory, because an addict will simply avoid drug use if a urine test is announced in advance or if a routine collection time becomes apparent.

Drug abuse detection requires knowledge of the suspected drug's biologic half-life, extent of biotransformation, and major route of excretion.[81] The primary clearance of fentanyl is metabolic. McCain and Hug[82] estimated that renal clearance of fentanyl in volunteers was only 6%. Based on this work, a regular user should have detectable fentanyl in urine for 3–5 days. Nanogram quantities of fentanyl can be detected in the urine, though there are a number of reports from "recovering" addicts who report regular fentanyl abuse not detected on routine urine tests.[1] Norfentanyl, a fentanyl metabolite, can be detected in the urine up to 96 h after small (100-μg) doses of fentanyl and should probably be the analysis of choice.[1] The metabolism of sufentanil is similar to that of fentanyl, and it is possible to detect the metabolite for a period of time that is longer than the interval for detection of the parent compound.

Morphine-3-glucuronide is the primary inactive metabolite of morphine. Detectable in the plasma 1 min after intravenous administration of morphine sulfate, it is detectable in urine for up to 72 h.[83] Meperidine is primarily metabolized to normeperidine, a compound that can be detected in the urine for as long as 3 days after administration.[83]

Hair Analysis

The half-lives of most of the agents typically abused by anesthesiologists are short, and the circulating concentrations are often too weak for detection at the time of urine or blood sample collection. An alternative method developed to detect chronic exposure to these drugs of abuse is the analysis of hair samples obtained from the individual under the same chain-of-custody guidelines as for urine or blood samples. Depending on the length of the hair, it is possible to test exposure over a period of time measured in months rather than hours or days.[70] Hair can serve as a marker of chronic exposure because drugs of abuse or their metabolites are incorporated into the structure of the hair follicle over time as the hair grows. The actual mechanisms of substance incorporation are unclear, but it is believed that drugs or chemicals either passively diffuse from blood capillaries into growing hair cells or are deposited onto the completed hair shaft from sweat or sebum secretions.[84]

The chromatographic–mass spectrometric techniques used today have increased test sensitivity and improved detection limits such that picogram to microgram levels of agent or metabolite can be detected.[85] Despite the ability to detect minute quantities of substances in the hair of individuals suspected of illicit drug use, certain limitations do exist. The most obvious is that the individual to be tested needs to have hair on which to perform the desired assay. It is not infrequent for an individual to arrive at the testing location having either trimmed or shaved their hair entirely. While such actions are telling in and of themselves, hair for forensic analysis may be obtained from alternative areas, such as the underarms, pubic area, chest, or thigh, if hair from the scalp is not available.[85]

When a positive result is obtained, often there is objection, and the question of contamination arises. Experiments have shown that positive test results can be obtained when hair has been environmentally exposed to particular agents, either by proximity to drug use or by intentional contamination. Hair experimentally contaminated with both the solid hydrochloride form and the evaporated base of cocaine has tested positive for use in subjects who have not ingested the drug.[86,87] Because of the implications of such a positive result, hair samples should not be taken in a physical site where the chemical to be tested for is present. Moreover, the individual taking the sample should thor-oughly cleanse their hands before and wear gloves when obtaining the sample.

Naltrexone Assays

Naltrexone assays exist as a measure of patient compliance with mandated ingestion. Difficulties reside in the stability of the specimen. One laboratory will only accept serum or plasma that is wrapped in foil and shipped frozen. Because of sample instability, a negative test result may not indicate noncompliance with prescribed naltrexone ingestion. The only reliable measure of compliance with naltrexone therapy is witnessed ingestion.

Reliability of Assays

The requirements for urine drug testing of anesthesia personnel include accurate forensic testing for fentanyl and its derivatives, as well as other commonly abused drugs. A major concern, given the high stakes involved with the monitoring of a physician addict, remains the accuracy of the testing laboratories.[88,89] Performance testing, in the form of known blind samples, should be submitted to the designated laboratory on a regular basis (*e.g.*, 3 per 100 specimens) from high-volume testing centers. Knowledge of the laboratory's error rate (either false positive or false negative) on these blind controls is essential in evaluating analytic results.[1]

Misleading Positive Results

The report of significant concentrations of codeine and morphine in urine at 6 and 22 h after the consumption of three poppy seed bagels by Struempler[90] in 1987 highlighted the necessity for further evaluation of a positive test result. This is not a false positive, because the actual substance being assayed was present and detected. It represents a positive result with a cause unrelated to substance abuse. When a positive test result is attributable to the ingestion of poppy seeds, specific ratios of codeine to morphine can be identified.[91] Still, recovering addicts are advised to avoid the consumption of poppy seeds. In addition to dietary causes, nonprescription medications may also result in misleading positive results.[92] Because of this, many Impaired Physicians Programs specifically require that participants familiarize themselves with and abstain from any foods or nonprescription medicines that, when ingested, might lead to a positive test result for drugs of abuse.

Cost

The cost of initial drug screens is usually borne by the hospital or department, but the recovering addict is often required to bear the cost of ongoing monitoring. One laboratory in New York State currently charges $32.50 for a screening urine test with a fentanyl assay, but the price jumps to $290 per sample if a propofol assay is requested. Hair analysis can cost well over a

thousand dollars per sample. This is a significant expense for individuals requiring six to eight screens per month as part of a monitoring program, especially for those who do not have insurance to help defray the costs of treatment. Responsibility for the expense of testing should be clear and agreed to in advance. Often, arrangements for bulk discounts can be made by medical societies or hospitals.

Conclusions

Addiction is still considered by many to be an occupational hazard for those involved in the practice of anesthesiology. It has been suggested in this review that the presence of readily available highly addictive agents in our work environment contributes to the potential for abuse in a subset of the population at risk. Because it is not possible to identify these people before they become addicted, it is essential that each of us learn to recognize the signs and symptoms of addiction when they become manifest, such that we may preserve the safety of both our colleagues and the patients they care for. Although some highly motivated individuals have been able to successfully reenter the clinical practice of anesthesia and avoid relapse, this is not always the case. Successful completion of a treatment program does not guarantee freedom from future relapse, even several years into recovery. As such, each case must be carefully evaluated before the decision is made to allow an addicted physician to attempt a return to the practice of anesthesiology.

References

1. Silverstein JH, Silva DA, Iberti TJ: Opioid addiction in anesthesiology. ANESTHESIOLOGY 1993; 79:354–75

2. Collins GB, McAllister MS, Jensen M, Gooden TA: Chemical dependency treatment outcomes of residents in anesthesiology: Results of a survey. Anesth Analg 2005; 101:1457–62

3. Kintz P, Villain M, Dumestre V, Cirimele V: Evidence of addiction by anesthesiologists as documented by hair analysis. Forensic Sci Int 2005; 153:81–4

4. Wischmeyer PE, Johnson BR, Wilson JE, Dingmann C, Bachman HM, Roller E, Tran ZV, Henthorn TK: A survey of propofol abuse in academic anesthesia programs. Anesth Analg 2007; 105:1066–71

5. Hughes PH, Baldwin DC Jr, Sheehan DV, Conard S, Storr CL: Resident physician substance use, by specialty. Am J Psychiatry 1992; 149:1348–54

6. Gold MS, Byars JA, Frost-Pineda K: Occupational exposure and addictions for physicians: Case studies and theoretical implications. Psychiatr Clin North Am 2004; 27:745–53

7. Brewster JM: Prevalence of alcohol and other drug problems among physicians. JAMA 1986; 255:1913–20

8. Krizek TJ: The impaired surgical resident. Surg Clin North Am 2004; 84: 1587–604

9. Talbott GD, Gallegos KV, Wilson PO, Porter TL: The Medical Association of Georgia's Impaired Physicians Program review of the first 1,000 physicians: Analysis of specialty. JAMA 1987; 257:2927–30

10. Alexander BH, Checkoway H, Nagahama SI, Domino KB: Cause-specific mortality risks of anesthesiologists. ANESTHESIOLOGY 2000; 93:922–30

11. Booth JV, Grossman D, Moore J, Lineberger C, Reynolds JD, Reves JG, Sheffield D: Substance abuse among physicians: A survey of academic anesthesiology programs. Anesth Analg 2002; 95:1024–30

12. Report of the Board of Trustees. JAMA 1956; 162:750

13. Lettieri DJ: Drug abuse: A review of explanations and models of explanation, Alcohol and Substance Abuse in Adolescence. Edited by Stimmel B. New York, Haworth, 1985, pp 9–40

14. Tapper AR, McKinney SL, Nashmi R, Schwarz J, Deshpande P, Labarca C, Whiteaker P, Marks MJ, Collins AC, Lester HA: Nicotine activation of $\alpha4^*$ recep-

tors: Sufficient for reward, tolerance, and sensitization. Science 2004; 306: 1029–32

15. Mohn AR, Yao WD, Caron MG: Genetic and genomic approaches to reward and addiction. Neuropharmacology 2004; 47:101–10

16. Lesch KP: Alcohol dependence and gene x environment interaction in emotion regulation: Is serotonin the link? Eur J Pharmacol 2005; 526:113–24

17. Hiroi N, Agatsuma S: Genetic susceptibility to substance dependence. Mol Psychiatry 2005; 10:336–44

18. Kreek MJ, Nielsen DA, LaForge KS: Genes associated with addiction: Alcoholism, opiate, and cocaine addiction. Neuromolecular Med 2004; 5:85–108

19. Picciotto MR, Zoli M, Rimondini R, Lena C, Marubio LM, Pich EM, Fuxe K, Changeux JP: Acetylcholine receptors containing the $\beta2$ subunit are involved in the reinforcing properties of nicotine. Nature 1998; 391:173–7

20. Wang JC, Hinrichs AL, Stock H, Budde J, Allen R, Bertelsen S, Kwon JM, Wu W, Dick DM, Rice J, Jones K, Nurnberger JI Jr, Tischfield J, Porjesz B, Edenberg HS, Hesselbrock V, Crowe R, Schuckit M, Begleiter H, Reich T, Goate AM, Bierut LJ: Evidence of common and specific genetic effects: Association of the muscarinic acetylcholine receptor M2 (CHRM2) gene with alcohol dependence and major depressive syndrome. Hum Mol Genet 2004; 13:1903–11

21. Luo X, Kranzler HR, Zuo L, Wang S, Blumberg HP, Gelernter J: CHRM2 gene predisposes to alcohol dependence, drug dependence and affective disorders: Results from an extended case-control structured association study. Hum Mol Genet 2005; 14:2421–34

22. Nace EP, Davis CW, Gaspari JP: Axis II comorbidity in substance abusers. Am J Psychiatry 1991; 148:118–20

23. Udel MM: Chemical abuse/dependence: Physicians' occupational hazard. J Med Assoc Ga 1984; 73:775–8

24. Markou A, Kosten TR, Koob GF: Neurobiological similarities in depression and drug dependence: A self-medication hypothesis. Neuropsychopharmacology 1998; 18:135–74

25. Sekine Y, Minabe Y, Ouchi Y, Takei N, Iyo M, Nakamura K, Suzuki K, Tsukada H, Okada H, Yoshikawa E, Futatsubashi M, Mori N: Association of dopamine transporter loss in the orbitofrontal and dorsolateral prefrontal cortices with methamphetamine-related psychiatric symptoms. Am J Psychiatry 2003; 160:1699–701

26. Malison RT, Best SE, Wallace EA, McCance E, Laruelle M, Zoghbi SS, Baldwin RM, Seibyl JS, Hoffer PB, Price LH: Euphorigenic doses of cocaine reduce [123I]beta-CIT SPECT measures of dopamine transporter availability in human cocaine addicts. Psychopharmacology 1995; 122:358–62

27. Heinz A, Ragan P, Jones DW, Hommer D, Williams W, Knable MB, Gorey JG, Doty L, Geyer C, Lee KS, Coppola R, Weinberger DR, Linnoila M: Reduced central serotonin transporters in alcoholism. Am J Psychiatry 1998; 155:1544–9

28. Gold MS, Melker RJ, Dennis DM, Morey TE, Bajpai LK, Pomm R, Frost-Pineda K: Fentanyl abuse and dependence: Further evidence for second hand exposure hypothesis. J Addict Dis 2006; 25:15–21

29. White RK, Kitlowiski EJ: Physicians in recovery. Md Med J 1998; 37:183–9

30. Annitto WJ, Gold MS: Treating the "high and mighty" and the "mighty high," Dual Diagnosis in Substance Abuse. Edited by Gold MS, Slaby AE. New York, Marcel Dekker, 1991, pp 289–95

31. Talbott GD: The impaired physician and intervention: A key to recovery. J Fla Med Assoc 1992; 69:793–7

32. Berry AJ, Arnold WP: Chemical Dependence in Anesthesiologists: What You Need to Know When You Need to Know It. Park Ridge, Illinois, American Society of Anesthesiologists Task Force on Chemical Dependence of the Committee on Occupational Health of Operating Room Personnel, 1998

33. Walzer RS: Impaired physicians: An overview and update of the legal issues. J Leg Med 1990; 11:131–98

34. Gualtieri AC, Cosentino JP, Becker JS: The California experience with the diversion program for impaired physicians. JAMA 1983; 249:226–9

35. Casper E, Dilts SL, Soter JJ: Establishment of the Colorado Physician Health Program with a legislative initiative. JAMA 1988; 260:671–3

36. Carden ET: Wither the impaired physician? The politics of impairment. Md Med J 1988; 37:206–10

37. Revocation of ABA certification. ABA News 2006; 19(1):4

38. Roback HB, Moore RF, Waterhouse GJ, Martin PR: Confidentiality dilemmas in group psychotherapy with substance-dependent physicians. Am J Psychiatry 1996; 153:1250–60

39. Gendel MH: Forensic and medical legal issues in addiction psychiatry. Psychiatr Clin North Am 2004; 27:611–26

40. Medical Practices Act, Colorado revised statutes, §§12–36–117, 118 (amended 1995)

41. Westreich LM: Addiction and the Americans with Disabilities act. J Am Acad Psychiatry Law 2002; 30:355–63

42. Metzner JL, Buck JB: Psychiatric disability determinations and personal injury litigation, Principles and Practice of Forensic Psychiatry. London, Arnold, 2003, pp 672–84

43. *Traynor and McKelvey v Turnage*, 485 US 539 (1988)

44. Menk EJ, Baumgarten RK, Kingsley CP: Success of reentry into anesthesiology training programs by residents with a history of substance abuse. JAMA 1990; 263:3060–2

45. Hankes L, Bissell L: Health Professionals, Substance Abuse: A Comprehensive Textbook. Edited by Lowinson JH, Ruiz P, Millman RB. Baltimore, Williams & Wilkins, 1992, pp 897–908

46. Pelton C, Ikeda RM: The California Physicians Diversion Program's experience with recovering anesthesiologists. J Psychoactive Drugs 1991; 23:427–31

47. Kirn TF: Advances in understanding of alcoholism initiate evolution in treatment programs. JAMA 1986; 256:1405–12

48. Rounsaville B, Karroll K: Individual psychotherapy for drug abusers, Substance Abuse: A Comprehensive Textbook. Edited by Lowinson JH, Ruiz P, Millman RB. Baltimore, Williams & Wilkins, 1992, pp 496–507

49. Fletcher CE, Ronis DE: Satisfaction of impaired health care professionals with mandatory treatment and monitoring. J Addict Dis 2005; 24:61–75

50. Canavan DI: Screening: Urine drug tests. Md Med J 1987; 36:229–33

51. Killeen TK, Brady KT, Gold PB, Simpson KN, Faldowski RA, Tyson C, Anton RF: Effectiveness of naltrexone in a community treatment program. Alcohol Clin Exp Res 2004; 28:1710–7

52. Haley TJ: Disulfiram (tetraethylthioperoxydicarbonic diamide): A reappraisal of its toxicity and therapeutic application. Drug Metab Rev 1979; 9:319–55

53. Galanter M, Talbott D, Gallegos K, Rubenstone E: Combined AA and professional care for addicted physicians. Am J Psychiatry 1990; 147:64–8

54. Galanter M, Casteneda R, Franco H: Group therapy and self-help groups, Clinical Textbook of Addictive Disorders. Edited by Frances RJ, Miller SI. New York, The Guilford Press, 1991, pp 431–51

55. Herrington RE, Benzer DG, Jacobson GR, Hawkins MK: Treating substance use disorders among physicians. JAMA 1982; 247:2253–7

56. Samkoff JS, Krebs JR: Families and physician impairment. Pa Med 1989; 92:38–9

57. O'Connor PG, Spickard A Jr: Physician impairment by substance abuse. Med Clin North Am 1997; 81:1037–52

58. Arico S, Zannero A, Galatola G: Family compliance to a treatment programme for alcoholics: A prospective study of prognostic factors. Alcohol 1994; 29:679–85

59. Singh J, Basu D: Ultra-rapid opioid detoxification: Current status and controversies. J Postgrad Med 2004; 50:227–32

60. van Dorp EL: Naloxone treatment in opioid addiction: The risks and benefits. Expert Opin Drug Saf 2007; 6:125–32

61. Collins ED, Kleber HD, Whittington RA, Heitler NE: Anesthesia-assisted *versus* buprenorphine- or clonidine-assisted heroin detoxification and naltrexone induction: A randomized trial. JAMA 2005; 294:903–13

62. Gallegos KV, Browne CH, Veit FW, Talbott GD: Addiction in anesthesiologists: Drug access and patterns of substance abuse. QRB 1988; 14:116–22

63. Matsumura JS: Substance abuse and anesthesiology training. JAMA 1990; 264:2741–2

64. Talbott GD: Elements of the Impaired Physicians Program. J Med Assoc Ga 1984; 73:749–51

65. Collins GB, McAllister MS, Jensen M, Gooden TA: Chemical dependency treatment outcomes of residents in anesthesiology: Results of a survey. Anesth Analg 2005; 101:1457–62

66. Bryson EO, Levine A: One approach to the return to residency for anesthesia residents recovering from opioid addiction. J Clin Anesth 2008; 20:397–400

67. Domino KB, Hornbein TF, Polissar NF, Renner G, Johnson J, Alberti S, Hankes L: Risk factors for relapse in health care professionals with substance use disorders. JAMA 2005; 293:1453–60

68. Fletcher CE, Ronis DL: Satisfaction of impaired health care professionals with mandatory treatment and monitoring. J Addict Dis 2005; 24:61–75

69. Farley WJ, Talbott GD: Anesthesiology and addiction (editorial). Anesth Analg 1983; 62:465–6

70. Kintz P, Villain M, Dumestre V, Cirimele V: Evidence of addiction by anesthesiologists as documented by hair analysis. Forensic Sci Int 2005; 153:81–4

71. Adler GR, Potts FE III, Kirby RR: Narcotics control in anesthesia training. JAMA 1985; 253:3133–6

72. Moleski RJ, Easley S, Barash PG: Control and accountability of controlled substance administration in the operating room. Anesth Analg 1985; 64:989–95

73. Shafer AL, Lisman SR, Rosenberg MB: Development of a comprehensive operating room pharmacy. J Clin Anesth 1991; 3:156–66

74. Schmidt KA, Schlesinger MD: A reliable accounting system for controlled substances in the operating room. ANESTHESIOLOGY 1993; 78:184–90

75. Epstein RH, Gratch DM, Grunwald A: Development of a scheduled drug diversion surveillance system based on an analysis of atypical drug transactions. Anesth Analg 2007; 105:1053–60

76. Lutsky I, Hopwood M, Abram SE: Psychoactive substance use among American anesthesiologists: A 30-year retrospective study. Can J Anaesth 1993; 40:915–21

77. Substance-Abuse Testing Committee American Association for Clinical Chemistry: Critical issues in urinalysis of abuse substances: Report of the substance-abuse testing committee. Clin Chem 1988; 34:605–32

78. Chamberlain RT: Legal issues related to drug testing in the clinical laboratory. Clin Chem 1988; 34:633–6

79. Peat MA: Analytical and technical aspects of testing for drugs of abuse: Confirmatory procedures. Clin Chem 1988; 34:471–3

80. Blanke RV: Accuracy in Urinalysis, Urine Testing for Drugs of Abuse. NIDA Research Monograph No. 73. Edited by Hawks RL, Chaiang NC. Washington, DC, Government Printing Office, 1986, pp 43–53

81. Vereby K: Diagnostic laboratory: Screening for drug abuse, Substance Abuse: A Comprehensive Textbook. Edited by Lowinson JH, Ruiz P, Millman RB. Baltimore, Williams & Wilkins, 1992, pp 425–36

82. McCain DA, Hug CC Jr: Intravenous fentanyl kinetics. Clin Pharmacol Ther 1980; 28:106–14

83. Stoelting RK: Opioid agonists and antagonists, Pharmacology and Physiology in Anesthetic Practice. Philadelphia, JB Lippincott, 1987, pp 69–101

84. Henderson GL: Mechanism of drug incorporation into hair. Forensic Sci Int 1993; 63:19–29

85. Pragst F, Balikova MA: State of the art in hair analysis for detection of drug and alcohol abuse. Clin Chim Acta 2006; 370:17–49

86. Romano N, Barbera G, Lombardo I: Hair testing for drugs of abuse: Evaluation of external cocaine contamination and risk of false positives. Forensic Sci Int 2001; 123:119–29

87. Romano N, Barbera G, Spadaro Valenti V: Determination of drugs of abuse in hair: Evaluation of external heroin contamination and risk of false positives. Forensic Sci Int 2003; 131:98–102

88. Clark HW: The role of physicians as medical review officers in workplace drug testing programs: In pursuit of the last nanogram. West J Med 1990; 152:514–24

89. Davis KH, Hawks RL, Blanke RV: Assessment of laboratory quality in urine drug testing: A proficiency testing pilot study. JAMA 1988; 260:1749–54

90. Struempler RE: Excretion of codeine and morphine following ingestion of poppy seeds. J Anal Toxicol 1987; 11:97–9

91. elSohly NH, elSohly MA, Stanford DF: Poppy seed ingestion and opiates urinalysis: A closer look. J Anal Toxicol 1990; 14:308–10

92. Fitzgerald RL, Ramos JM Jr, Bogema SC, Poklis A: Resolution of methamphetamine stereoisomers in urine drug testing: Urinary excretion of R(−)-methamphetamine following use of nasal inhalers. J Anal Toxicol 1998; 12:255–9