American Society of Anesthesiologists®

SUD CURRICULUM
Committee on Occupational Health

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Sections

Substance Use Disorder (SUD) – Content Outline

I. History of chemical dependency by anesthesia providers
   a. Scientists in the 19th century experimented on themselves
   b. Self-administration of drugs
   c. Non-medicinal uses
      i. Ether
      ii. Nitrous oxide
      iii. Chloroform
   d. Early anesthetic drugs
      i. Cocaine
      ii. Morphine
   e. One of the most serious occupational risk of giving anesthesia

II. Scope of the problem
   a. Cause of death data for physician anesthesiologists
      i. Fear of cancer and organ toxicity from working with potent drugs
      ii. Actually, no increase in cancer, heart, lung, liver or kidney disease
      iii. Bruce (1968) – low death rate, except three times as much suicide
      iv. Lew (1979) – 6.95 accidental (higher), 6.2 percent suicide, 3.4 times greater in young males
   b. Higher suicide rate in physicians compared to lay public (Williams, 1971)
   c. Suicide rate higher in anesthesiologists than physicians in general (Blachy, 1963)
   d. Incidence of SUD in Anesthesia providers
      i. Booth (1997) – 1.6 percent/year for residents, 1 percent/year for faculty
      ii. Collins (2005) – 80 percent of programs with a case, 19 percent with a death, comparable incidence in D.O. programs
      iii. Ward (1982) – 1 percent/year for first five years
      iv. Gravenstein (1983) – 1 percent/year, 7 out of 44 cases died
      v. Berry (2000) – United Kingdom, 39 percent of departments with a case within a 10-year interval
      vi. Weeks (1993) – comparable data to Berry's report within Australia, New Zealand
      vii. Bell (1999) – incidence same or greater in CRNA, SRNA
      viii. Warner (2013) – ABA database, 0.86 percent SUD in residents, 7.3 percent mortality, 43 percent 30-year relapse rate
      ix. Warner (2015) – ABA database part 2, death in 14.3 percent of SUD vs. 1.3 percent controls. 15-fold increase to not finish residency, tenfold not to become board certified, sevenfold more likely to have adverse licensure action.

x. Rosenberg (1986) – comparable incidence in oral surgery programs that provide anesthesia training, proportional to time in anesthesia
xi. Spiegelman (1984) – 10 percent mortality

III. Causes of SUD in Anesthesia Providers

a. Familiarity with drugs
   i. Access
   ii. Repeated experience with administration and observation of effects
   iii. Advanced parenteral administration skills
   iv. Pre-addictive behavior during medical school
   v. Illicit drug experiences in the past
      1. Drawn to anesthesia by access
      2. “The Candy Store”
b. Occupation exposure to the addictive drugs
   i. Deliberate self-exposure (self-medication)
      1. High rate of SUD follows
   ii. Contact in the workplace
      1. During opening of ampules
      2. On anesthesia work surfaces in O.R.
      3. From exposure to exhaled patient gasses
   iii. Neurochemistry of addiction
      1. Chemical changes in brain reward centers
      2. Down-regulation of D-2 dopamine receptors
      3. Creation of reactive oxidative species creating electron transfer by addictive substances
      4. Quinone metabolites of propofol/fentanyl cause electron transfer
   iv. “Start-to-Finish” controlled drug handling
      1. Unique to anesthesia
      2. Decide to medicate, choose drug, draw up drug, administer the drug, observe the effect, chart the administration and handle waste documentation. All with minimal, if any assistance. No one else in the medical center does this.
      3. High level of parenteral administration skills
      4. Ideal training for self-medication
      5. Drawn to anesthesia by the “chemical solution” to problems (hemodynamics, pain, anxiety, etc.)
      6. Fallacy of control – “If I can do it to my patients, I can do it to myself. I can handle it”. First time that an opioid is self-administered, there is addiction, the individual just doesn’t know it yet.

v. Work environment
   1. Work in isolation
   2. Long work hours
   3. Production pressure
   4. High stress environment
   5. Self-esteem issues
   6. Delayed gratification
vi. Psychiatric co-morbidity
   1. Depression
      a. Increased incidence in anesthesia
      b. Higher in residents than staff
      c. Seasonal
      d. Self-medication as a symptom
      e. Associated with suicide
      f. Associated with increased relapse rate
      g. Associated with addiction
   2. Personality disorders
      a. Associated with SUD
   3. Primary psychiatric diagnosis
   4. High risk behavior

IV. Chemicals associated with SUD and anesthesia
   a. Before 1980
      i. Meperidine
      ii. Diazepam
      iii. Barbiturates
   b. After 1980
      i. The fentanyl family
         1. Including intranasal remifentanil
      ii. Nitrous oxide
      iii. Midazolam
      iv. Ketamine
         1. Associated with prior psychotropic illicit drug use
      v. Lidocaine
         1. Dysphoria
      vi. D-tubocurarine ("I just relaxed")
      vii. Ephedrine
      viii. Cocaine
      ix. Antihistamines

   c. Other drugs with increasing incidence
      i. Propofol – tenfold increase over last decade
      ii. Inhaled agents- high morbidity, mortality, relapse rate
      iii. Less tight substance controls

V. Risks of Diversion
   a. Transmission of infectious diseases (Hepatitis C)
      i. Patients
      ii. Coworkers
   b. Public perception of addiction within anesthesia
   c. Violation of state, federal law
      i. Felony
      ii. Loss of licensure
      iii. Denial of board certification
      iv. Revocation of board certification

VI. Detection of SUD
   a. Self-reporting (rare)
   b. Overdose, accidental death, coma
   c. Direct observation
   d. Investigation of suspicious behavior
   e. Unexplained changes in performance
   f. Random drug testing
      i. Urine toxicology
      ii. Hair analysis
   g. Electronic screening of use patterns

VII. Re-entry
   a. Addiction as a disease
      i. Federally protected disability
   b. In-patient treatment, extended interval
      i. Best at center with specialty expertise
   c. Graded re-entry (no nights, weekends for an extended interval)
   d. Re-entry contract
      i. Handling of all substances by another provider
      ii. Random drug testing – strictly enforced
      iii. Attendance at meetings with attendance documented
      iv. Naltrexone or buprenorphine considered
      v. Monitoring of performance, behavior
   e. Favorable outcome
      i. Physicians do better in rehab

ii. Physicians do better in rehab for prescription opioids
iii. Role of Physician Health Committees (PHC)
iv. Risk of job change
1. Loss of PHC oversight with state change

f. Unfavorable outcome
i. Failure to finish training
ii. High relapse rate
iii. Death as a presentation of relapse
iv. 9 percent mortality (Collins, 2005)
v. High career relapse rate (Warner, 2015)
vi. Re-exposure to triggering environment

VIII. Prevention

a. Healthy lifestyle
b. Management of stress
c. Education of trainees
d. Prevention of diversion
i. Electronic dispensing
ii. Surveillance
iii. Random testing of waste solutions
iv. Electronic use profiles

e. Random drug testing
i. Cost
ii. Randomization technique versus bias
iii. "beat the test"
iv. Intrusion of the clinical work flow
v. Medical Review Officer
vi. Urine versus hair versus saliva
vii. "One strike and you're out"
viii. Perception of the medical community
1. "Drug testing- get used to it"
ix. Government position
1. Suggested universal random testing of those providers with access to controlled drugs
x. Lay public
1. "Junkie in the O.R." (Men's Health, October 2006)
2. USA Today (April 2014)
3. Newsweek (June 2015)

f. Systematic detection of diversion

i. Investigation of all discrepancies
ii. Multi-disciplinary response team
iii. Random chemical analysis of waste solutions
iv. Zero tolerance for diversion

SUD – Model Curriculum

PGY-1

Wearing Masks 1
Annual Departmental Grand Rounds
Stress Management and Personal Well-Being
Orientation to hospital physician health committee
Content Outline II, III
Journal Club –

1. Bryson EO, Silverstein JH. Addiction and substance abuse in Anesthesiology. *Anesthesiology*. 2008;109:905-17.
2. Gravenstein JS, Kory P, Marks RG. Drug abuse by anesthesia personnel. *Anesth Analg*. 1983:62467-72
3. Fitzsimons MG, Baker KH, Lowenstein E, Zapol WM. Random drug testing to reduce the incidence of addiction in anesthesia residents: Preliminary results from one program. *Anesth Analg*. 2008;107:630-5.
4. Tetzlaff J, Collins GB, Brown DL, Leak BC, Pollock G, Popa D. A strategy to prevent substance abuse in an academic anesthesiology department. *J Clin Anesth*. 2010;22:143-150

PGY-2

Wearing Masks 2
Annual Departmental Grand Rounds
Impairment and Anesthesiology Residency–PowerPoint
Content Outline I, II, III, IV
Journal Club –

1. Warner DO, Berge K, Sun H, Harman A, Hanson A, Schroeder DR. Substance use disorder among anesthesiology residents, 1975-2009. *JAMA*. 2013;310:2289-2296
2. Warner DO, Berge K, Sun H, Harman A, Hanson A, Schroeder DR. Risks and Outcome of substance use disorder among anesthesiology residents. A matched cohort analysis. *Anesthesiology*. 2015;123:1-8.
3. Booth JV, Grossman D, Moore J, Linberger C, Reynolds JD, Reves JG, Sheffield D. Substance abuse among physicians: A survey of academic anesthesiology programs. *Anesth Analg.* 2002;95:1024-30.
4. 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.
5. McAuliffe PF, Gold MS, Bajpai L, Merves ML, Frost-Peneda K, Pomm RM, Goldberger BA, Melker RJ, Cendan JC. Second-hand exposure to aerosolized intravenous anesthetics propofol and fentanyl may cause sensitization and subsequent opiate addiction among anesthesiologists and surgeons. *Medical Hypothesis*. 2006;66:874-882
6. Wischmeyer PE, Johnson BR, Wilson JE, Dingmann C, Bachman HM, Roller E, Vu Tran Z, Henthorn TK. A survey of propofol abuse in academic anesthesia programs. *Anesth Analg*. 2007;105:1066-71.

7. Wilson JE, Kiselanova N, Stevens Q, Lutz R, Mandler T, Vu Tran Z, Wischmeyer PE. A survey of inhalation anaesthetic abuse in anaesthesia training programs. *Anaesthesia*. 2008;63:616-20.

PGY-3

Annual Departmental Grand Rounds
Chemical Dependency and Anesthesiology–PowerPoint
Risks Associated with Diversion of Controlled Substances
Content Outline V, VI, VIII
Journal Club –

1. Berge KH, Dillon KR, Sikkink KM, Taylor TK, Lanier WL. Diversion of drugs within health care facilities, a multiple-victim crime: Patterns of diversion, scope, consequences, detection, and prevention. *Mayo Clin Proc*. 2012;87:674-82
2. Hellinger WC, Bacalis LP, Kay RS, et al. Health care- associated hepatitis C virus infections attributed to Narcotic diversion. *Ann Int Med*. 2012;156:477-82.
3. Domino KB, Hornbein TF, Polissar NL, 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.
4. Skipper GE, Campbell MD, DuPont RL. Anesthesiologists with substance use disorders: A 5 year outcome study from 16 state physician health programs. *Anesth Analg*. 2009;109:891-6.

PGY-4

Annual Departmental Grand Rounds
Orientation to State Physician Health Program
Content Outline I-VIII (revisited)
Journal Club –

1. Vigoda MM, Gencorcelli FJ, Lubarsky DA. Discrepancies in medication entries between anesthetic and pharmacy records using electronic databases. *Anesth Analg*. 2007;105:1061-5.
2. Chisholm AB, Harrison MJ. Opioid abuse amongst anaesthetists: a system to detect personal usage. *Anaesth Intensive Care.* 2009;37:267-71.
3. Epstein RH, Gratch DM, Grunwald Z. Development of a scheduled drug diversion surveillance system based on analysis of atypical drug transactions. *Anesth Analg*. 2007;105:1053-60.
4. Epstein RH, Gratch DM, McNulty S, Grunwald Z. Validation of a system to detect scheduled drug diversion by anesthesia care providers. *Anesth Analg*. 2011;113: 160-4.
5. 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.

Chemical Dependency and Anesthesiology – Syllabus

The discovery of anesthesia and addiction to the drugs used to provide anesthesia have a common origin. Cocaine had a social use profile before its incidental discovery as a topical anesthetic. Experiments with injection of cocaine to anesthetize plexus and peripheral nerves led to addiction of early 20th century master surgeons, such as Halsted, who performed the experiments.[1] Early experimentation with ether, nitrous oxide and chloroform also caused psychological and even physical addiction. It is not surprising, therefore, that addiction to anesthetic drugs and anesthesiology remain linked and that addiction remains the most prevalent, serious occupational health risk associated with anesthesia. Because of the morbidity, much is known.

Scope of the Problem

Although addiction to anesthetic drugs has become a prominent issue for anesthesiology in the United States, this issue is neither new nor restricted to the U.S. In an early report, Bruce[2] reported on the mortality and causes of death of anesthesiologists, noting lower death rates in most categories, except suicide, which was three times the rate for other physicians (1947–1966). Lew[3] reported similar data (1954–1976), with lower overall age-adjusted mortality, except for 6.2 percent suicide (two-times normal) and 6.9 percent "accidental." Although the suicide rate is higher in general for physicians[4], suicide in anesthesia providers is highly associated with addiction.[5] Ward[6] surveyed residency and nurse anesthesia programs for 10 years prior to 1982. With a 74 percent response rate, the incidence of addiction was 1 percent per year of giving anesthesia for the first five years. Gravenstein[7] reported the same 1 percent addiction rate with an alarming mortality of seven providers out of 44 reported. The issue also is not restricted to the United States. Berry[8] surveyed 304 departments of anesthesia in the United Kingdom and Ireland and found cases in this interval (1990–99) in 39 percent of departments reporting (71.7 percent response rate) and drew the remarkable conclusion that one anesthesia provider per month in the United Kingdom was disabled by addiction. Weeks reported a comparably high incidence for Australia and New Zealand.[51] The risk is not limited to physician anesthesiologists, with comparable or higher rates in CRNAs, with as high as 10 percent risk for a full career.[9]

Even though the issues are now well known and education and prevention steps are widely in use, the incidence has not seemed to change. Booth[10] surveyed 133 programs in 1997, achieved a 93 percent response rate, and reported 1.6 percent addiction rate in residents and 1 percent in faculty, despite 47 percent of respondents reporting increased education and steps to prevent diversion of controlled drugs. Collins[11] surveyed 176 programs (M.D. and D.O.), achieving a 66 percent response rate, with 80 percent of responding programs reporting at least one incident in the interval (1991–2001) with 19 percent reporting mortality. If anything, the mortality may actually be increasing, by comparison of the Collins[11] data for the 1990s with the 10 percent mortality reported by Spiegelman.[12] Warner reviewed the ABA database between 1975 and 2009 and found the incidence to be highest after 2003 with an overall incidence of 0.86 percent incidence at some time during training and a 7.3 percent mortality of those who demonstrated substance abuse disorder.[103]

Speculation about the Cause

While there will never be absolute proof, there is a consensus that a variety of issues combine to create a high risk of addiction. These include exposure to the drugs, familiarity with their pharmacology, access, stress and the uniquely addictive properties of anesthetic drugs. Prior addictive and high-risk behaviors seem to be highly associated. Chemical experimentation in medical students has been reported[13] be 30 to 50 percent, and several reports have suggested that prior illicit drug use may motivate (consciously or unconsciously) the individual to choose anesthesia.[11,14] In a large series, high-risk behavior was found to be highly predictive of addiction.[15]

Occupational exposure seems to be a clear association. As previously mentioned, early experiments to create safe anesthesia techniques (nitrous oxide, ether, chloroform and cocaine) created victims of addiction in the investigators. The high incidence identified is even more remarkable when the early presentation of addiction is considered. In both physicians and CRNAs, the incidence of addiction is highest during the first five years of giving anesthesia.[6,16,17,18,52] There is other suggestive evidence that the risk is giving anesthesia. Oral surgery residents in some maxillofacial residency programs receive extensive training (often from physician anesthesiologists) in giving anesthesia, and they report the same incidence of addiction proportionate to time in anesthesia with the same drug profile.[17] The converse is equally true—physicians who do not practice anesthesia (internists) have a lower rate of addiction and suicide compared to an age and gender matched cohort of physician anesthesiologists. [53]

Simply experiencing clinical anesthesia alone is too simple of an explanation for the risk of addiction. Gold has presented a provocative hypothesis that aerosol contact with fentanyl during opening of fentanyl ampoules[1] or from exhaled breath of patients[72] or contact with fentanyl or propofol from working surfaces within the operating room[77] may cause neurochemical changes in the brain that predispose some providers to become addicted.[73] They confirmed this hypothesis by detecting fentanyl and propofol in the air in several locations within active operating rooms.[78] The American Society of Anesthesiologists (ASA) Committee on Occupational Health has responded with the observation that exposure to fentanyl as a cause is preliminary data that should be further evaluated, citing a variety of methodological issues.[57] The neurochemistry of addiction is becoming well understood, with chemical changes in the reward centers leading to exaggerated need for drug acquisition and exaggerated reward from experience with the drug.[89] Another possible explanation for addiction is a lower density of dopamine receptors in reward centers, resulting in less reward from natural reinforcers.[91,92] The changes in the D-2 dopamine receptor are persistent or permanent and have the same molecular morphology as brain injury.[113] In adults with addiction to gambling increased activity in the reward center in response to gambling prompts is detected by functional MRI, compared to controls.[101] Dopamine downregulation has also been implicated in eating disorders, analogous to substance-use disorder.[114] A molecular mechanism for the sensitization has been suggested by Kovacic, who reports that addictive substances have in common the ability to create reactive oxygen species (ROS) that result in electron transfer that activates brain reward centers.[80] Further work has established that metabolites of propofol and fentanyl create these ROS messengers.[81]

Other elements of anesthesia practice that contribute to addiction are less objective but undisputed. The anesthesia provider is unique in organized medicine in providing "start-to-finish" administration of controlled substances. Even the most junior resident physician will obtain fentanyl, draw it up, inject, observe the effect, chart the intervention and handle the accounting of waste, often without any observed assistance. No other resident physician routinely has this experience or possesses these skills. New anesthesia providers also rapidly learn the clinical pharmacology of these substances by observation, reading, and trial and error. This creates both the skill for self-medication and the more ominous skill to achieve painless suicide. Self-medication may be an occupational hazard of the operating room related to stress and lack of positive reinforcement. New anesthesia providers get a disproportionate level of the work, their skill level is lower and, as a result, their efficiency is low. And the operating room is rough on newcomers. These factors, combined with some natural curiosity about the drugs being used, create an unfortunate propensity for anesthesia newcomers to self-mediate. They know how and what to use, but the fallacy in the highly educated provider is that these anesthesia newcomers can control the experience. Unfortunately, this initiates a cascade of use and addiction that accelerates at a very rapid rate. Gold[1] reports a case where a single experiment with intranasal accelerated to injection of 30 mL/day of sufentanil within 30 days. In the context of high stress, reduced self-esteem and availability of synthetic opioid, Ward[18] states that control is gone after the first self-medication even though the individual doesn't know it. Farley[19] identifies other unique element of anesthesia practice, including a "chemical solution" to solving problems and the isolated nature of anesthesia practice. Moleski[20] further speculates that routine use of controlled substances minimizes the importance of tight accounting, desensitizing the individual to its relevance.

Other features may be triggering events for the subset of providers. Prior experience with substance abuse or high-risk behavior has been previously identified. A prior history of psychiatric illness (contributory or coincident) can be contributory in the addicted anesthesia provider.[15,16,21] Personality disorders[74] and primary psychiatric diagnoses[75] are commonly found in addicted physicians, and self-medication may represent a response to these symptoms.[76] Burnout and depression are reported to be prevalent within anesthesiology, particularly among physician anesthesiology residents.[108] Depression is known to be associated with suicide, and although complicated, may be linked to self-medication and addiction.[82] There is strong evidence for a genetic susceptibility to addictive behavior, especially the transition from abuse to dependency.[88] Self-medication of psychiatric symptoms is a major cause of relapse of substance abuse disorder.[109]

Drugs Involved in Addiction for Anesthesiologists

From the substance abuse literature, the progression of substance (ETOH to marijuana to cocaine) is a common observation. Addiction within anesthesiology does not follow this pattern. Although the incidence of addiction to drugs used in anesthesia is alarmingly high, the incidence of abuse of illicit drugs (alcoholism, THC, cocaine) is low. Addiction within anesthesia has always focused on anesthetic drugs. Prior to 1980, the drugs involved were meperidine, diazepam and barbiturates.[22,23] After 1980, addiction has been heavily concentrated in the fentanyl family.[6,10,17,19] Although parenteral fentanyl is the rule, severe addiction to oral fentanyl has been reported; the victim was a nursing supervisor who lacked some of the parenteral administration skills.[24] While rapid metabolism would seem to make parenteral remifentanil abuse seem unlikely, intranasal self-administration has been reported as the entry point to a fentanyl addiction.[79] Midazolam[17] and ketamine[25] have been reported in addiction cases, as has nitrous oxide[54] and potent inhalation agents, such as enflurane.[26] In a survey of academic departments, 22 percent reported at least one incident with an inhaled agent with less than half of the individuals involved entering rehabilitation, less than 30 percent return to practice and a 26 percent mortality rate.[64] Propofol is the newest player on the scene with one case report[27] involving injection to unconsciousness up to 15 times per day. In another case report, propofol replaced a benzodiazepine because of superior sedative properties for the affected physician.[110] In a survey of academic anesthesiology programs from 1995–2005, Wischmeyer reported 18 percent of programs had a propofol abuse incident with 28 percent of the cases detected by death.[71] Repeated prior exposure to propofol may be causative, with experience of the euphoria leading to intense craving and psychological dependence.[94,95,96]

The addiction potential with anesthetic drugs has been reviewed. Propofol has been tested in volunteers and found to have properties associated with addiction,[27] although the pharmacokinetics predict a difficult abuse pattern, requiring either pump infusion or frequent, intermittent injection. The addictive potential for other uncommon substance has been predicted based on the side effect profile,[28] including local anesthetics (dysphoria), cocaine (euphoria, stimulation), anticholinergics (psychotomimetic), antihistamines (sedation) and ephedrine (stimulant). Ketamine has an obvious role in those with prior illicit psychedelic drug use, such as LSD, or PCP.[25,29]

Detection

Self-reporting of serious addiction is uncommon. Direct observation of abuse and audits that confirm suspicion are the most common means of detection. Unfortunately, suicide, accidental death and coma combined are more common than self-reporting.[19] Suicide during evaluation of possible addiction is a serious issue.[30] Intervention must be conducted carefully, with the goal of getting the suspected addict into a safe treatment facility, using progressively increasing motivators like reporting, termination and, as a last resort, police involvement. In one case, the cause of death was determined to be propofol by hair analysis where blood and urine toxicology were negative.[31] In cases where suspicion is high and urine toxicology is repeatedly negative, hair analysis has detected addiction to fentanyl, sufentanil and alfentanil.[55] Detection of drugs with brief half-lives such as ketamine, midazolam and propofol are difficult or impossible in routine toxicology,[27,32] and may require either observed abuse and rapid “for-cause” screening or hair analysis.[33,55] The fentanyl family is especially difficult to detect because of the brief plasma half-life and non-detection of metabolites.[24,34] A computer profile of drug use to detect outliers might be a better approach.[35] Epstein has prospectively applied this computer profile and demonstrated that it detects diversion months before clinical detection, although its sensitivity needs to be refined before it becomes a first line tool, due to false positives.[87] Another electronic approach using run charts comparing individual use against time to identify upward trends in individuals also shows promise.[90] A promising opportunity for detection is a urine assay for detection of the glucuronide metabolites of propofol, which remains present in the urine for up to three days after exposure.

The urgency for detection of substance diversion has never been low, but it has increased dramatically with the disclosure that individuals involved in diversion have used techniques that have resulted in injury to patients. Clusters of hepatitis infection have been traced to diversion practices of an infected health care provider.[98] Irresponsible handling of diverted substances and/or equipment presents a risk to all other health care workers.[99] The risk is particularly relevant given the variable level of prevention of diversion from institution to institution and state to state.[100]

Re-entry

Addiction is a disease as well as a federally protected disability, as long as the addict remains in treatment.[67] Treatment only succeeds when evaluation reveals addiction and the victim is able to fully acknowledge their addiction. This is rarely, if ever, successful without in-patient treatment, graded re-entry with a contract, handling of addictive substances by other providers, and random testing, including periodic hair samples. More controversial are the pharmacotherapeutic options, including naltrexone[111] and buprenorphine.[112]

Even with the risk, a simple majority of providers will want to re-enter anesthesia. The outcome, however, is not always promising. In general, physicians have a better outcome in rehabilitation from addiction[102] than non-physicians[36] even from opioid (prescription) abuse.[60] The California Physician Diversion Program's data suggests that this rehabilitation outcome also applies to addiction involving physician anesthesiologists, although their definition of recovery may be very generous.[37] Some other data is in agreement,[38] however, there is also evidence that re-entry is both ineffective and risky. Collins reports a 40 percent failure rate with re-entry of residents and 9 percent mortality. Re-entry for student nurse anesthetists has the same poor prognosis.[39] Menk reports 34 percent successful re-entry for residents with 16 percent having the first presentation of relapse as death.[40] Bryson[58] reported a graded re-entry of residents involving work in a simulation center for the first 12–15 months prior to re-entry. The value of this approach has been challenged[59] in light of the 60 percent relapse rate they report, and there remains a serious doubt that re-entry is ever the right choice for a resident.[(67] The failure rate, the cost to the department with attempted re-entry, and the mortality rate led Berge,[(68] in an editorial in the journal *Anesthesiology*, to advocate "one strike and you're out," a universal prohibition to re-entry. Oreskovich[69] and others responded to this strong position with circumstances where this would be excessive and highlighted the role of the highly effective state Physician Health Committees (PHC). It may be that the resident failure rate is related to the less universal role of PHC in the re-entry of residents.

Hedberg[41] has attempted to quantify the process by defining criteria that predict success and failure with re-entry. He has divided anesthesia providers in rehabilitation into three categories based on specific criteria; category two requires delay and re-evaluation of individuals after one to two years, category three consists of individuals who should never practice anesthesia. Domino reports greatly increased risk of relapse when there is a coexisting psychiatric disorder, family history of substance abuse, or in those addicted to opioid, with the increase even greater if more than one of these risk factors is present.[56] Re-entry may actually oppose the process of recovery by re-exposing the addict to the visual, olfactory or physical cues to the emotions that triggered self-medication and also may explain why delayed re-entry is required.[65] If re-entry is attempted, the focus should be on relapse prevention.[84] There is even risk of relapse from subsequent required medical care, if exposure to triggering substances (opioids, propofol) is required for medical or surgical care.[93]

Prevention

There is universal agreement that mandatory education about the risk of substance abuse, stress and fatigue management should be a part of all anesthesia training programs at the entry point and regularly thereafter. There is also general agreement that this education process should continue beyond residency, although this is less universally applied. Despite evidence that the majority of training programs have increased their education programs, Booth[10] reports no change in the incidence of substance abuse. Previous reports of inadequate education[42] have created the education but not decreased the risk. Increased effort to prevent the diversion of controlled substances has also been instituted in a majority of programs[10,43] including locked boxes, dispensing machines, video surveillance and satellite pharmacies. Some effect has been observed, including reduced controlled substance discrepancy.[20] Electronic data analysis can reveal average user profiles, and provide detection via outliers.[20,35]

The subject of random drug testing is controversial.[83] The almost infinite number of ways to tamper with urine toxicology screening must be considered.[70,86] The issue of false positives, even with the use of a medical review officer, remains an administrative issue with intense consequences.[107] Although a promising avenue in the future, detection of anesthesia drugs in oral fluid is not possible at this time.[85] In responses to the survey of Booth,[10] a majority of chairs favored random testing, although only two programs outside the military have instituted such a program. Fitzsimons[61] presented the first five years of one of these programs designed to prevent addiction which includes a random testing element and reported no addicted providers detected. The Department of Transportation (DOT) has had a random screening program for almost two decades for commercial drivers, railroad and airline pilots. Industry has followed, with more than 90 percent of companies with more than 5,000 employees having some kind of testing.[44] Random testing programs have been shown to reduce positives[45] and save health care dollars. Mike Scott, previous council to ASA, has written a review of random testing,[46] in which he identifies the AMA endorsement of "for cause" testing and discusses the unresolved legal issues with random testing. Although random testing is prohibited in 12 states, there are exceptions for industry involved in safety. The AMA expressed concerns in an editorial which discusses privacy, handling of false positives, confidential records and the approaches to randomization.[47] A more recent editorial in by Pham in *JAMA* advocated random urine testing for all physicians as a means of ensuring patient safety.[104] Although disputed in responding letters to the editor of *JAMA* based on lack of supporting evidence,[105,106] the same sentiment was echoed in an editorial in the New York Times ("Why Aren't Doctors Drug Tested?", March 12, 2014) which advocated universal drug testing for all health care workers with contact to controlled substances. DOT rules have created the need for the role of a Medical Review Officer, a physician with specific training to handle the initially positive screen.[48] All recovering physicians are subject to random screening during recovery and any failure or absence requires action.[49] Collins'[11] data reveals a slightly higher rate of pre-employment screening (16 percent) and pre-employment toxicology screening. Based on the kind of data in Men's Health[50] ("The Junkie in the O.R.") and two recent cases that made headline news in the press on the East Coast, the lay public may begin to demand random screening. Media coverage of sensational issues regarding addiction of health care providers and diversion will only add to this message.[115,116] It is clear that detection during residency training is a responsibility of the residency program.[62] Failure to report provider impairment may incur legal liability for the anesthesia department, the hospital or anesthesia groups who know.[63] Regardless of the legal risk, protocols for handling of impairment and substance abuse should be present in every department.[66]

Conclusion

Substance abuse is the most serious occupational safety hazard for anesthesiology. Causing devastating consequences to the career, morbidity, personal stress and death, it is a high-attractive target for prevention. The nature of anesthesia (working alone, production pressure, isolation) and the handling of highly addictive drugs are contributors. Up to 1 percent per year of residents may become addicted. The mortality rate of relapse may approach 9 percent. Prevention by education, tight control of controlled substance use, profiling for outliers and possibly random urine toxicology may be needed to arrest this serious hazard of providing anesthesia.

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