Death from Propofol: Accident, Suicide, or Murder?

Robert R. Kirby, MD*  
JAMES M. COLOW, J D†  
Sgt Michael M. Douglas, BA  
Criminal Justice‡

A 24-yr-old woman was found dead in her home from apparent propofol “toxicity.” Her blood level of propofol was 4.3 μg/mL. She had no history of drug abuse and no evidence of such behavior at autopsy. The medical examiner and police investigators felt that she died from probable homicide. Attention was focused on a male registered nurse acquaintance, who had acquired propofol and other drugs in the course of his regular duties in a surgical intensive care unit. This is the first reported case of murder with propofol.

P ropofol has been used in anesthesiology since 1986. Although its clinical properties are well known to anesthetists and providers, knowledge concerning its abuse potential and more complex issues, such as its use in suicide, are less commonly appreciated. Before 1992, clinicians and the manufacturer were convinced that such abuse was rare to nonexistent. Since 1992, however, reports have been published (largely in forensic medical journals) concerning abuse, accidental overdose and suicide. Presented herein is the first report involving murder with propofol, and a review of the literature about propofol diversion.

CASE DESCRIPTION

A 24-yr-old, 5'5" in., 138 pound female was found dead in her house near Gainesville, Florida by police detectives and fire rescue personnel on November 10, 2005. Numerous items, including syringes, needles, and two empty 20 mL vials of 1% propofol (10 mg/mL), were found in grocery store bags lying on the ground adjacent to garbage cans outside the house. After the initial crime scene investigation, an autopsy was performed. The left antecubital fossa had a pinpoint puncture wound with underlying subcutaneous hemorrhage. The puncture wound directly overlaid a subcutaneous vein. No other premortem physical abnormalities were noted.

Laboratory analysis revealed a blood propofol concentration of 4.3 μg/mL. This value is within the range of blood propofol concentrations (1.3–6.8 μg/mL) after a bolus induction dose of 2.5 mg/kg of body weight. The medical examiner ruled that the manner of death was homicide. She noted that the fatal dose of propofol was administered by someone with skill in IV injections.

Follow-up investigation of the propofol national drug code lot numbers on the bottles at the crime scene revealed the drug had been obtained from an automated Omnicell® dispenser (Omnicell Headquarters, 1201 Charleston Road, Mountain View, CA) by a male registered nurse who worked in the surgical intensive care of Shands Hospital at the University of Florida. The most recent propofol had been dispensed to him on November 3, 2005. On or about the day of her death (between November 8 and 9, 2005), he left the area, subsequently went briefly to Georgia on approximately November 24, 2005, and ultimately flew to Ireland on November 29, 2005.

After further investigation, a second degree murder warrant was issued for the suspect on January 24, 2006. In June 2006, he was apprehended in the West African Republic of Senegal. On October 16, 2006, he was transported to the Alachua County Department of the Jail by the United States Marshall’s Service, and on November 29, 2007, the prior indictment for second degree murder was upgraded to first degree murder. Trial commenced on May 19, 2008. On May 23, he was found guilty of first degree murder and was sentenced to life in prison without the possibility of parole.

DISCUSSION

In cases such as this one, investigation involves the determination of the following: was drug abuse or drug dependence involved, and was death accidental, by suicide or caused by a third party? Drug abuse is “the use of a psychoactive substance in a manner detrimental to the individual or society but not meeting criteria for substance or drug dependence.” Drug dependence is characterized by several typical findings including “1) compulsion or craving; 2) loss of control over the amount or frequency of the drug used, and 3) continued use of the drug despite adverse consequences.”

The abuse potential of propofol was not recognized initially. As late as 1992, Stuart Pharmaceuticals reported no propofol abuse or “Diprivan-seeking” behavior. However, propofol is increasingly popular as a drug of abuse for several reasons, including rapid onset (<1 min) and short duration of action (5–10 min) after IV injection of 1.5–2.5 mg/kg.2–12 Abuse dosing is simplified, because one vial contains 200 mg (a kind of “unit dose”), which can be divided into smaller amounts if desired. The drug sometimes is taken for...
relief of chronic headache or migraine\textsuperscript{13} and has been used for this purpose in pain clinics. Physical dependency is rare, although psychological dependency may occur because of associated euphoria, relief of stress, brief respite from pain, sexual fantasies and dreams, and sexual disinhibition upon awakening.\textsuperscript{2,3,4,11} These same characteristics have been described after anesthesia and monitored anesthesia care.

Whether suicide is possible with propofol has been debated. Some investigators historically said no, because the maximum that was thought to be injectable, before the individual lost consciousness and was incapable of injecting more, was one vial (200 mg). This amount is equivalent to a standard anesthetic induction dose of 2.5 mg/kg to a healthy 80 kg individual. However, several alternate views suggest how suicide might be possible. For example, the individual could mix a much larger dose of several hundred or more milligrams of propofol for rapid, continuous IV infusion. By this approach, drug inflow would continue despite loss of consciousness. Repeated doses could be self-administered after arousal from each preceding dose (although this method is unlikely to cause death because of the rapid decline of blood and brain levels through redistribution and metabolism). A very rapid injection of a normal dose can cause prolonged apnea, extreme hypoxia, and hypotension.\textsuperscript{4,7,9,11} Such episodes that would be easily treated in the operating room may be fatal to propofol abusers who wish to commit suicide or to others who accidentally administer propofol too rapidly.

The epidemiology of propofol abuse is unfamiliar to most of the anesthesia providers. Propofol generally has not been listed as a controlled substance. Because it is not associated with physical dependency, the drug has not received a great deal of attention for addictive potential. When it is abused, detection of the abuser is difficult as the after-effects are fleeting and not particularly noticeable.\textsuperscript{3} In the first reported case of propofol abuse by an anesthesiologist, the abuser chose propofol because the substance was easily attainable, ultra short-acting, and without long-term side effects.\textsuperscript{2} Subsequently, injection frequencies up to 100 times per day were reported.\textsuperscript{2}

At least 38 human cases of abuse/dependency have been published in peer-reviewed literature for the 15-yr period from 1992 to 2007.\textsuperscript{4,10–13} However, many more cases are probable, because only the most serious appear to have been described.\textsuperscript{4} Of the 38 cases, 14 (37%) were fatal. Twelve of these deaths occurred in medical professionals, nine of whom were anesthesia providers.\textsuperscript{5–12} Most of those deaths now are thought to have occurred because of the rapidity of propofol injection which led to apnea and death.\textsuperscript{4} The blood propofol level in seven deaths was lower than or within the commonly accepted therapeutic range of 1.3–6.8 $\mu$g/mL after a standard anesthetic induction dose. Thus, as noted by Kranioyi et al.,\textsuperscript{11} “... a mere interpretation of the blood and tissue concentrations of propofol in the toxicological analysis may be of limited value. . . .” A brief summary of the death cases follows.

\textbf{Case 1}
A 29-yr-old female radiologist committed suicide by apparent self-administration of propofol.\textsuperscript{5} This was the first published report of death by overdosage with propofol. Her postmortem femoral blood concentration of propofol was 0.22 $\mu$g/mL. The scene suggested that a total dose of 400 mg was used.

\textbf{Case 2}
A 37-yr-old male was suspected of having fatally self-administered sequential IV doses totaling 1600 mg of propofol.\textsuperscript{6} The femoral blood propofol level was 2.5 $\mu$g/mL.\textsuperscript{5}

\textbf{Case 3}
A 26-yr-old male nurse was found dead in his home surrounded by partly empty and unused ampules of propofol and two syringes.\textsuperscript{7} His partner reported that the decedent had abused propofol for years. His blood propofol level was 5.3 $\mu$g/mL. Death was felt to have been caused by an overly rapid injection of a normal dose of propofol.

\textbf{Case 4}
A 44-yr-old female nurse anesthetist was found dead at home.\textsuperscript{8} Screening revealed midazolam, propofol, and ethanol in her femoral blood. Segmental analysis of head, axillary, and pubic hair confirmed the repetitive abuse of midazolam and propofol for 6 mo before death. Her blood propofol level was 0.039 $\mu$g/mL.

\textbf{Case 5}
A 27-yr-old male nurse anesthetist was found dead at home after self-administration of propofol for recreational purpose.\textsuperscript{9} Several puncture wounds suggested chronic abuse during the preceding days. Three empty ampules of propofol were discovered beside him, and unused ampules were found in his car. His blood propofol concentration was 0.026 $\mu$g/mL. Forensic investigation found acute pulmonary edema and hemorrhagic pancreatitis.

\textbf{Case 6}
A drug-induced fatality occurred in a 21-yr-old layman who had inserted a permanent IV catheter for the injection of propofol several times daily.\textsuperscript{10} Propofol was purchased through online eBay auctions. His postmortem blood propofol level was 0.071 $\mu$g/mL.

\textbf{Case 7}
A 38-yr-old female anesthesiologist was found dead in a hospital dormitory, the doors of which were locked from the inside.\textsuperscript{11} Three empty propofol vials were next to her body. She had been a known propofol abuser for several months before her death. At autopsy, her alveoli were filled with pink, foamy, bloody
fluid. Femoral blood analysis revealed a propofol level at 2.4 µg/mL.

**Cases 8–14**

A recent study examined all 126 anesthesiology resident training programs in the United States to determine the level of propofol abuse. Propofol abuse was noted in 18% of departments, representing a fivefold increase over previous studies and an incidence of 10 cases/10,000 anesthesia providers/decade. Twenty-five abusers were reported for the 10-yr period from 1995 to 2005, seven of whom died as a result of the abuse (six residents and one operating room/anesthesia technician). All deaths occurred in training programs with no controls over propofol use.

In all reported cases of suicide or accidental death from propofol, the drug and paraphernalia with which to administer it were found inside and next to the victims’ bodies. In the case we presented, the investigation concluded that, in this case, there was no way the victim could have self-injected 400 mg of propofol, gathered all the drug vials and injection paraphernalia into garbage bags which were then tied, walked outside to dispose of the materials, come back inside and then collapsed on her bed. Thus, another person or persons had to be present, had to administer the propofol, and had to clean up the crime scene before leaving.

We do not advocate placing restrictions on propofol that impede access to its clinical use. Propofol has many characteristics of an ideal IV induction and maintenance drug. It is critically important that propofol be readily available to anesthesiologists for induction and maintenance of anesthesia and sedation. Restrictions would not affect the illicit diversion of propofol, and would almost certainly result in harm to patients. Certainly, this death cannot be blamed on propofol. The victim was murdered, and many of other drugs would have been equally effective as murder weapons. To quote Paracelsus: “Poison is in everything, and no thing is without poison. The dosage makes it either a poison or a remedy.”

**REFERENCES**