Homicides Using Muscle Relaxants, Opioids, and Anesthetic Drugs

Anesthesiologist Assistance in Their Investigation and Prosecution

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ANESTHETICS, opioids, and muscle relaxants can decrease breathing and other vital processes to the extent that death will ensue if ventilation is not supported. These drugs have thus been used for euthanasia, suicides, and state executions.[1–3] Criminals have also recognized the lethal capabilities of anesthetics and during recent years have committed homicides using hypnotics, inhalational general anesthetics, opioids, and muscle relaxants.[4–6]

An analysis of 523 homicidal poisonings occurring between 1999 and 2005 found that the rate of such poisonings was increasing and 65% involved medicines.[7] The death of singer Michael Jackson from propofol in 2009, the identification of propofol as an anesthetic, and the coroner's ruling the death a homicide received extensive publicity.§ Other recent deaths and mercy killings using anesthetics have also received publicity.[8]‖

An increasing recognition of the use of muscle relaxants and anesthetics for homicides seems likely to involve anesthesiologists in homicide investigations and prosecutions.[9] The authors report their experiences with four homicides and one attempted homicide to inform anesthesiologists that prevention of drug diversion is important and to advise how they can assist prosecutors. The West Virginia University Institutional Review Board exempted these cases from review because they did not involve patients or research subjects.

CASE REPORTS

Case One: Homicide Using Rocuronium

A 35-yr-old nurse practitioner was convicted in 2007 for the murder of her husband. She became a murder suspect after investigators discovered she had lied about an extramarital affair and had surreptitiously left work and driven to her house shortly before the house was discovered on fire with her husband inside.

The victim's body was badly burned. Blood carbon monoxide concentrations, however, were not increased, an indication that he was not breathing and already dead at the time of the fire. Investigators then sent heart, blood, and liver tissue samples for pharmacologic analysis, including muscle relaxants. Results showed rocuronium concentrations of 4.9 and 14.4 μg/ml in the blood and liver, respectively. Although the presence of rocuronium itself was legally significant, the blood concentration exceeded the mean effective concentration to produce paralysis of approximately 2 μg/ml.[10] Review of the materials found in the burned house revealed a charred needle cap similar to that used in the hospital where the nurse practitioner worked.

Expert testimony sought by prosecutors involved a description of the effects of rocuronium on muscle function and consciousness, the kinetics of rocuronium after intramuscular administration, and the mechanism of death by muscle relaxants. Also required was an explanation of the availability of rocuronium in hospitals as well as a demonstration of how rocuronium is administered.

Testimony (by REJ) in this case was particularly difficult because family members and friends of the victim sat in the courtroom facing the witness stand and reacted emotionally to descriptions of muscle paralysis while awake, air hunger,

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§ Landau E. Drugs that killed Jackson for clinical use only, experts say. CNNHealth.com. August 28, 2009. Available at: www.cnn.com/2009/HEALTH/08/28/jackson.toxicology.drugs/index.html. Accessed November 18, 2010.

‖ CBS News. Death without Mercy–48 Hours. April 18, 2009. Available at: www.cbsnews.com/stories/2008/01/02/48hours/main3667638_page3.shtml. This television coverage relates to Case One. Accessed November 18, 2010.

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and the probable sequence of death. Because the precise dose of rocuronium administered or site of administration was not known, onset times had to be given in ranges, with the disclaimer that effects depended on the actual dose. For example, intramuscular administration of 1.8 mg/kg of rocuronium in children will produce complete twitch depression in 5–6 min.[11]

Case Two: Homicide Using Succinylcholine

The wife of an anesthesiologist died suddenly and unexpectedly. Although the initial death certificate did not list homicide as the cause of death, the father of the wife suspected foul play, and an investigation was launched. One of us (RLK) reviewing information about this case learned that the anesthesiologist had previously been tried for murder and was found not guilty. This previous trial followed the sudden and unexpected death of the husband of a woman with whom he had allegedly been having an affair. With the help of RLK, the district attorney theorized that the anesthesiologist had injected succinylcholine into the buttocks of the first victim while he slept. The body was exhumed and detailed examination revealed a fractured hyoid bone. It was then speculated that an injected dose of succinylcholine produced apnea but had begun to wear off before death, so the first victim was strangled. A second autopsy of the deceased wife found a high concentration of choline in her buttocks. Choline concentrations in plasma reflect those of succinylcholine.[12] The anesthesiologist in this case from 1967 went on trial, was found guilty, and was sent to jail.

Case Three: Homicide Using Fentanyl

A 23-yr-old pharmacist who worked in a large city crime laboratory was convicted of murdering her husband with fentanyl. She called 911 after claiming to have discovered her husband unconscious and apneic in their apartment when she returned from an afternoon of shopping. She reported finding him lying in bed with their wedding picture and rose petals. When paramedics arrived at the apartment, the woman was performing cardiopulmonary resuscitation on her husband. The paramedics took over resuscitation at the scene and in the ambulance but soon after arrival at the emergency department of the nearest hospital the husband was pronounced dead. Initial analysis of blood and gastric fluid samples found no barbiturates, benzodiazepines, or other drugs commonly taken for suicide. The discovery that fentanyl (fentanyl patches, crystalline fentanyl, and vials of the opioid) was missing from the woman's place of employment triggered a reanalysis of the husband's blood and gastric fluid samples for the presence of fentanyl. Extremely high concentrations (57 ng/ml) of the drug were present. The minimum effective blood concentration of fentanyl administered intravenously during patient-controlled analgesia is 0.6 ng/ml.[13]

At the 2002 trial the prosecuting attorney presented evidence that the pharmacist stole fentanyl from her place of employment and fed her husband soup laced with the drug. The prosecutor claimed that as the woman's husband became somnolent from the soup she was feeding him, she placed numerous fentanyl patches on his chest and arms. These patches were not on his body when the paramedics arrived but there was some evidence the patches had been previously applied. Finally, the attorney showed that the woman purchased roses using her own credit card a few hours before she called 911. The motive for the murder was that her husband would not agree to a divorce that she wanted in order to continue an affair with another pharmacist at her place of employment. Her husband had also threatened if she pursued a divorce to reveal to her employer that she was a methamphetamine addict, which could have resulted in the loss of her job.

Testimony in this case (by THS) involved confirming that the fentanyl blood concentration was high enough to produce apnea and death that could have resulted from the consumption of fentanyl-laced soup and fentanyl patches applied to the husband's body. The woman was sentenced to life in prison.

Case Four: Accidental Homicide from Fentanyl and Midazolam

A 39-yr-old physician, general practitioner, called 911 from a hotel room in a small agricultural community. The victim was a 22-yr-old, 225 lb, 6-ft-4-in mentally challenged former patient whom the physician had befriended after caring for him in the emergency department of a large-city general hospital several months earlier. The victim had suffered respiratory arrest after multiple intramuscular and intravenous injections of fentanyl and midazolam. The physician was performing cardiopulmonary resuscitation on the victim when the paramedics arrived. The paramedics took over resuscitation at the scene and in the ambulance, but the victim was dead on arrival at the hospital. The physician admitted he had injected the drugs into the victim so that he could "practice intubating" the victim and that the victim "didn't mind him doing this." The hotel room was arranged so that a movie camera was focused on the victim and a few frames of film within the camera showed the physician practicing laryngeal intubation on the victim. Most of the film in the camera and approximately 25 other videos showed the victim lying supine and breathing quite slowly while deeply sedated with the physician applying oils and creams on the abdomen, genitals, and upper legs of the victim. Blood samples of the victim taken in the emergency department demonstrated high concentrations of both fentanyl and midazolam. Testimony in this 2004 case (by THS) involved confirming that the fentanyl and midazolam blood concentrations were sufficiently high to produce apnea, especially when considering that the two drugs can act synergistically in decreasing respiratory function. The physician was sentenced to 10–20 yr in prison.

Case Five: Attempted Homicide Using Pancuronium

Hospital personnel noted that several patients of a particular anesthesiologist had suddenly become apneic in the postanesthesia care unit after having seemingly recovered from their anesthetics. Because administration of neostigmine restored ventilation in these patients, respiratory depression was diagnosed due to nondepolarizing muscle relaxants. Although a rebound effect of intraoperative muscle relaxants was initially suspected, one of the patients had not received muscle relaxants during surgery. A nurse reported that in one case

she had seen a surgeon who had not operated on the patient at bedside shortly before he stopped breathing. That surgeon and the anesthesiologist for the apneic patients had been engaged in a bitter work dispute. When the locker of the surgeon was searched, full and empty vials of pancuronium were found, as well as syringes and needles. Although one of us (RLK) helped develop a mechanism for attempted homicide in this 1969 case, prosecutors decided that the evidence was insufficient to bring it to trial. After the discovery of the muscle relaxant vials in the surgeon's locker and a public review of the known facts, no further cases of recovery room apnea occurred.

Discussion

The public is learning from both novels and news reports that anesthetics and muscle relaxants can cause death. *Inside the Minds of Healthcare Serial Killers* describes multiple murders with pancuronium by a nurse referred to as "The Angel of Death,"[14] and *Playing with Fire* reports the rocuronium homicide in case one.[15] Extensive news coverage was given to the killing of 127 terrorists and hostages with an aerosolized fentanyl analogue and halothane by Russian special forces in 2002 and to the assassination in 2010 of a Hamas military commander carried out with the administration of succinylcholine.# In 2003 a German physician was accused of killing 76 patients with morphine.[16] Criminals may thus think of, and use, anesthetics and muscle relaxants more often to commit murder.

We report four homicides and one attempted homicide involving rocuronium, succinylcholine, fentanyl, and pancuronium in which we assisted the investigation and prosecution. These case reports have not previously been available to anesthesiologists and illustrate some areas where anesthesiologists can help criminal investigators and prosecutors. Such help has been required previously by prosecutors[4,17] and could become more common. In table 1 we list some ways anesthesiologists can assist homicide investigations and prosecutions.

Because the legal defense in murder trials frequently relies on creating reasonable doubt in the minds of jurors about the involvement of the accused and the proposed cause of death, anesthesiologists should review the thoroughness of the investigation and prepare their testimony broadly and carefully. Trial testimony may involve questions about natural causes of death, suicide with muscle relaxants, ability to access anesthetics, mechanisms of administration,[18,19] timing of drug effects, and accuracy of autopsy and laboratory findings, as well as the qualifications of the expert. Explanations must be presented in terms that jurors can understand. Press coverage, emotional responses from people in the courtroom, and confrontational questions can make testimony in murder trials particularly difficult. In addition, the person on trial in cases involving murder by muscle relaxant or anesthetic is often a healthcare worker, occasionally a physician. Expert testimony may be covered in front-page newspaper articles or network television shows. Appeals of homicide convictions often occur for several years after the original trial, which means time commitments for experts can be lengthy.

Table 1. Anesthesiologist Assistance during Homicide Investigations and Testimony

Recommend specific anesthetic drugs, muscle relaxants, and metabolites for tissue and blood analyses
Explain the meaning and limitations of drug tests
Explain how muscle relaxants and anesthetic drugs can cause death
Describe probable route for drug administration
Explain drug dosages and effect timing
Explain anesthetic drug storage and access in institutions
Explain the probability of various natural causes of death
Describe expert qualifications in anesthesiology

The drugs used in four of the cases we report came from hospitals. Drug diversion from operating rooms is a recognized problem.[20] The increasing frequency of anesthesia administered at sites outside the operating room suite is increasing the storage of anesthetics and muscle relaxants throughout hospitals, possibly making their diversion easier. Muscle relaxants are also stored in most critical care units, as well as on airway management and emergency carts. The Drug Enforcement Agency has not classified muscle relaxants or propofol as controlled substances, so they are not individually tracked in most hospitals. In 2002 a respiratory therapist pled guilty to 6 murders with pancuronium, and told police he may have killed up to 50 people with drugs he obtained in hospitals.** As illustrated in our case five, attempted homicides and homicides with anesthetics can occur in hospitals and have been prosecuted.[21] The handling of nonclassified anesthetics in hospitals to prevent diversion may require further review. Criminal investigators who suspect that a homicide could involve drugs should be reminded about the lethality of muscle relaxants and anesthetics and the need to test for them. Because scientific testing for curare was admitted into a homicide trial in 1978,[21] forensic laboratory analyses for muscle relaxants[22] and opioids[23] have become accepted.

Anesthesiologists who use powerful drugs to anesthetize patients and facilitate surgery should recognize that criminals can use these same drugs to depress breathing and commit murder. Homicides involving anesthetics may be increasing and require the assistance of anesthesiologists in their investigation and prosecution. Security of anesthetics is warranted.

Mahmoud al-Mabhouh. Wikipedia, available at: http://en.wikipedia.org/wiki/Mahmoud_al-Mabhouh. Accessed November 18, 2010.

** "Angel of Death" pleads guilty. CBS News, March 12, 2002. Available at: www.cbsnews.com/stories/2002/03/12/national/main503535.shtml. Accessed November 18, 2010.

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