

# Criminal Poisoning: Medical Murderers

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The possibility of homicide occurring at the hands of health care providers is unthinkable to most people. That is particularly true of those of us in the medical profession. Ironically, the failure of health care workers to consider a coworker as a murderer has caused delays in the recognition of those deaths as homicides and subsequently delayed the termination of further murders. There is a paucity of medical literature on this subject. When patient homicide is discovered, individuals and institutions are reticent to document it for fear of damage to their reputations and increased exposure to litigation. Although such events appear to be rare, it is safe to assume that more homicides occur than are known, and many more occur than are reported in the medical literature. In fact, the major source for such information is to be found in books and electronic media about serial killers. As a result, it must be noted that this article often reflects undocumented details of specific incidents. For the health care professional, the purpose of this article is to heighten awareness and to demonstrate that there are definite patterns to the personalities and methods in these events. Six past medical serial killers have been chosen for review to highlight those patterns and methods.

## Donald Harvey

Donald Harvey's career as a murderer began in May of 1970 in London, Kentucky at a small hospital where he worked as an orderly [1,2]. In a videotape developed by the International Association for Hospital Security for medical, security, and law enforcement personnel, he spoke at length about his victims and methods [2]. Harvey selected patients with poor communication skills and those who had little family interaction. In most cases he targeted elderly patients with chronic disease who had been hospitalized for extended periods.

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Harvey's early victims frequently were smothered or had their ventilation otherwise impaired. Among those victims was an elderly man who had splashed him with urine. In retaliation, Harvey inserted a 22 F catheter in the patient's bladder and threaded a straightened coat hanger through it, puncturing the man's bladder and pushing it the full length. Although the patient complained to a nurse that he had been abused by Harvey, his complaints were ignored. He died of peritonitis. Harvey used arsenic and found it to be an effective though somewhat unpredictable poison. Knowing that elderly patients are more likely to eat sweets, he added arsenic to their desserts. The resulting illness was a nonspecific gastroenteritis. Progression to death was gradual, requiring repeatedly administered small, sublethal doses. He also injected methanol, floor stripper, and adhesive remover intravenously and intramuscularly. Details of the clinical course of patients following these injections are sparse. He did note that decubiti and hemorrhoids were useful sites of injection because of the difficulty in detection at autopsy. Harvey claims to have used cyanide on several occasions. Like arsenic, he obtained it from laboratory supplies. He learned that with the exception of one doctor and one nurse many people at the hospital could not detect the notorious cyanide almond odor, a finding that has likewise been demonstrated in the medical literature [3,4]. On one occasion after a patient had been killed with an injection of cyanide the physician believed he smelled the odor but was dissuaded by Harvey's suggestion that instead it was the odor of vanilla in the patient's dessert.

Harvey found two times of day to be the most advantageous for carrying out his assaults. Change of shift tended to either group nursing personnel around the nurses' station and away from the patients' rooms, or if nurses made walking rounds he could enter patient rooms behind the nurses where he was undetected. Mealtimes also provided him with cover. On most floors half of the nursing staff would go to the cafeteria leaving only half the team to monitor the patients.

As an additional safeguard, Harvey developed a rudimentary alarm system. He closed the door to the patient's room, because most personnel knock before entering. A wastebasket was placed immediately behind the door so that the person entering would overturn it and then stop to right and reposition it. He drew curtains around the beds to obstruct the view and used laundry hampers and bedside tables to further obstruct the approach to the bedside where he was located. Finally, he bunched bedside curtains to obscure the point of entry.

The author and others [5] note that during the course of the interview, Donald Harvey appeared to relish the opportunity to educate his listeners. At times he appeared to embellish his statements, such as noting that he killed some of his victims simply by turning down the flow of their nasal cannula oxygen. All told, he claims to have murdered more than 70 people.

As a final note, Harvey stated he was cooperating to prevent such events from happening in the future. When asked if he would kill again given the

chance, he stated, “If I was still working in a hospital and had not been caught, yes” [2].

### **Kristen Gilbert**

In March of 1989, Kristen Gilbert took her first job as a registered nurse at the 197 bed Veterans’ Administration Medical Center (VAMC) in Leeds, Massachusetts [6,7]. Not long after, she began to be associated with unexpected sudden deaths in her patients or those on her floor. Months later, a VAMC physician also noted that Gilbert was associated with a disturbing number of unexpected deaths. He eventually asked her supervisor to avoid assigning her to care for his patients. Though fellow nurses initially did not share his concern, Gilbert became known as the Angel of Death. In 1991, while reviewing death records, a VAMC clerk noted that a single name, Gilbert’s, was associated with a most deaths on the Ward C intensive care unit where she worked. In a year, the deaths on her shift were triple the number on any other ward. Of the 31 deaths occurring between 1990 and 1991, she had discovered 22 and had initiated 50% of the codes, many times more than any of her coworkers. The clerk approached her nursing supervisor but reportedly was told to stop making false accusations. The supervisor later denied any recollection of that conversation.

By the beginning of 1996, Kristen Gilbert’s name was on 75% of the codes and 50% of the deaths occurring on Ward C since her employment in 1989. Even as the rate of codes increased, the Medical Emergency Committee, responsible for reviewing such events, did not appear to be alarmed. Her coworkers, on the other hand, had increasing suspicion. Concerned that Gilbert might be injecting patients with epinephrine, a coworker monitored the vials stocked on the floor. Following an unexpected code she found three epinephrine vials missing. Knowing that epinephrine injections used in codes are usually given in preloaded syringes, she realized that the missing vials should not have been used in the resuscitation. When she found the empty ampules in the trash following the code she realized they may have been used to precipitate the arrest. Guilt-ridden, three of Gilbert’s coworkers finally approached their supervisor. As a result, an investigation was begun after 7 years.

Gilbert eventually was convicted of three counts of first degree murder, one count of second-degree murder, and two counts of attempted murder. She was sentenced to life in prison. During the course of her activity she had used epinephrine, ketamine, and acepromazine to harm or kill patients.

### **Geneene Jones**

A licensed vocational nurse (LVN), Geneene Jones seemed bright, interested, and well read compared with others at her level of training [8,9].

She had lost her first job at San Antonio's Methodist Hospital allegedly for exceeding her authority. After losing a second job she came to the Pediatric Intensive Care Unit (PICU) of the Bexar County Medical Center in October of 1978. Early on, she exhibited bizarre behavior when a child died. Her orientation nurse described her behavior as berserk. She sat at the bedside and sobbed for half an hour, later developing an almost ritualistic response to deaths on the unit.

Genevieve had few friends and definite enemies. The nurses and residents who followed her orders and advice were favored, but those who did not defer to her were held in contempt and frequently derided to others on the unit. She began to make predictions about the children who were going to die, and when they did her crying vigils at the bedside and processions to the morgue became more bizarre. She committed several medication errors and at times refused to give medicines to children that she, an LVN, believed were not indicated. Amazingly, she was not fired.

In September of 1981, after the death of two children on Genevieve's shift, two coworkers had seen enough. There were too many deaths occurring. Because physicians and residents tend to rotate through and many of the nurses either came in and out from other units or were temporary workers, few people actually had a complete overview of what was occurring. Convinced Jones was connected to the increasing arrests in the unit, they collected data from the PICU's statistical log. Over the ensuing 6 months they compiled a chart of the deaths between January 1, 1981 and March 17, 1982. Several had occurred in children following innocuous surgical procedures and many had inexplicable causes. They found that in those 15 months, there had been 43 deaths. Genevieve Jones's assigned patients constituted 22 of them and she had been present for a total of 29. Because many of the children had multiple cardiac or respiratory arrests, the percentage at which Jones was present drew further concern. Cardiopulmonary arrests were occurring almost entirely on the 3:00 to 11:00 shift, when Genevieve worked. The coworkers went to the nursing administrator with their complaint but were rebuffed. Several days and two more deaths passed, but nothing changed. They took their concerns to the medical director of the PICU who seemed appropriately concerned. The medical director notified the director of pediatrics and at the latter's recommendation began reviewing the deaths for the preceding 6 months.

One physician became convinced that the recent spate of coagulopathies occurring in patients was related to overmedication with heparin. He questioned Jones as to the concentration she used when flushing heparin locks. Her response was 1000 times the proper dose. The medical director ordered that heparin dosing was to be witnessed by a second person thereafter. But Jones's patients continued to die.

In November of 1982, Genevieve took a month of medical leave. During that time, not a single code blue occurred. The medical director of the PICU was concerned, though his chart review did not show direct evidence

of Jones causing arrests. He was dealing with one of the ironies of detecting serial killers in hospitals: The killer is often the person who writes the note detailing pre-arrest events. The numbers troubled the medical director, however, especially in the face of a code-free period in Genevieve's absence. Within a week of her return, the codes began again.

What should have been the beginning of the end for Genevieve occurred when a child admitted to the unit for treatment of pneumonia mysteriously developed recurrent episodes of bleeding. With the child near death, a pediatric attending decided to give protamine empirically on the assumption that the hemorrhage was because of a heparin overdose. The bleeding stopped. The doctor ordered that the child be moved from the PICU and cared for only by nurses that he selected. As a result of his demands, the director of pediatrics initiated an internal investigation. He asked the director of nursing to talk with personnel in the PICU, and he planned to do a chart review.

In the meantime, a 4-month-old child was admitted to the unit following open-heart surgery. Initially he had respiratory problems but began to improve. When Jones took over his care on the next shift, she complained to the child's physician that he was not responding appropriately and needed a CT scan. The physician declined, stating that the problem was not neurologic. Later that day while coworkers were busy with another patient Jones approached a neurologist not involved in her patient's care. She assured him that the child was stable enough for a scan. In an attempt to help the PICU staff already engaged in a code, the neurologist ordered the scan. Jones accompanied the child to radiology where he arrested and died. The chief of cardiovascular surgery went to the director of pediatrics and was told an investigation was underway. Unimpressed, he threatened to stop admitting postoperative patients to the PICU. An emergency meeting of key administrators was convened. They decided that a panel of outside medical experts should review the charts and decide if further action would be warranted. Respected physicians from the United States and Canada were brought together but in the end they could not find sufficient evidence of homicide to act. The hospital decided to restrict the PICU nursing staff to registered nurses only, thereby preventing Genevieve Jones from working in that unit.

Eventually, Jones called a former resident whom she had befriended at the medical center. Kathleen Holland, a pediatrician, was setting up a practice in the small town of Kerrville Texas, about 60 miles northwest of San Antonio. Holland hired Jones to work in her clinic. The clinic opened on September 16, 1982. The following day, during a visit for cold symptoms, an 8-month-old child suffered a respiratory arrest. She recovered and her parents were thankful for the quick action of the clinic nurse, Genevieve Jones. During a checkup 9 months later the child suffered a second respiratory arrest and died. Her death occurred immediately after she received an injection by Genevieve. A missing vial of succinylcholine provided an important clue as to the cause of the nine respiratory arrests that occurred in the Kerrville

pediatric clinic. That child's death would eventually bring Genevieve Jones to court where in two separate cases she was sentenced to a total of 159 years. She is eligible for parole in 2009.

### **Michael Swango**

Michael Swango graduated valedictorian of his Quincy, Illinois high school class [10,11]. He had always had a preoccupation with violence. He graduated college with a 3.89 grade point average and entered the Southern Illinois University School of Medicine in 1979 where he worked as an emergency medical technician (EMT) during his medical school tenure. Swango's unusual behavior began to draw attention when he was assigned to work on the hospital wards. Five patients died mysteriously while under his care. Classmates joked that if they wanted a patient to die they would assign them to Double-O-Swango, a reference to the James Bond 007 license to kill.

In 1982 while on an obstetrics and gynecology rotation, the chief resident discovered Swango was leaving his duties to work as an EMT and was falsifying data on patients' records. She reported him to the medical school administration. To avoid expulsion, he hired an attorney and in a compromise agreed to repeat the rotation and complete his training. Although reportedly receiving a disparaging Dean's letter from his medical school, Swango was offered a general surgery internship and neurosurgical residency at Ohio State University.

The known murders appear to have begun in February of 1984 when a nursing student and a patient witnessed Swango injecting another patient's IV line a few minutes before she suffered a cardiac arrest, which she survived. The patient later wrote, "Someone gave me some medicine in my IV and paralyzed all of me, lungs, heart, and speech" [10]. She described Swango as the person, but he denied having been near her room. Several suspicious deaths occurred, prompting nurses to share their concerns about Swango with the nursing director, who then took them to the program director of neurosurgery. Their concerns reportedly did not impress the program director, but eventually Swango was suspended and an investigation begun. The investigation was performed by the program director in consultation with the hospital attorney and the dean of the College of Medicine. Swango was reinstated and allowed to finish his internship but not offered a position in the neurosurgical residency. Later, in response to scathing criticism including an ABC News report, two former Ohio State University officials reportedly conceded that more should have been done [12].

Swango returned to Illinois and resumed work as an EMT at Adams County Ambulance Corps. His paramedic coworkers saw him as somewhat bizarre but tolerated what they believed were idiosyncrasies because of his extensive medical knowledge. That attitude began to change after they experienced a series of episodes of sudden onset abdominal pain, nausea,

vomiting, and dizziness. The paramedics decided to set a trap. They left a pitcher of iced tea in a room where Swango would be alone. They retrieved the tea and had it tested. Swango had been adding arsenic obtained from Terro Ant Killer to his coworkers' beverages. Swango was eventually tried for seven counts of aggravated battery. He was convicted and sentenced to 5 years in prison, but paroled after 2-1/2 years.

Following his release, Swango found work as a laboratory technician at a coal company. His past had been forgotten to the extent that when several employees fell ill he was not suspected. In 1992, after sending numerous applications for employment as a physician, he was offered an internal medicine residency position in Sioux Falls, South Dakota. He and his girlfriend, a nurse, moved there and initially he performed his duties as a resident without known incident. Two events lead his residency director to discover his true past: an application to the American Medical Association triggered a background check that revealed his past conviction, and a rerun of an ABC television program was seen regarding his poisoning conviction in Illinois. Swango subsequently was expelled from the residency. Shortly thereafter his girlfriend died of a gunshot wound to the chest, believed to be self-inflicted. By June of 1993, Swango again gained admission to a residency program. This time he moved to New York for training in psychiatry at the State University of New York (SUNY), Stony Brook Medical School. Shortly after starting his clinical duties, at least five patients died unexpectedly and mysteriously under his care. He had added do not resuscitate orders to all of their charts. Swango was dismissed in October of 1993 when SUNY received word that he had falsified his application and that it included a pseudonym. SUNY conducted its own internal investigation concluding no harm had come to any patients. SUNY did, however, send out letters to medical school deans and contacted the Federal Bureau of Investigations (FBI), who subsequently opened an investigation.

Shortly after, Michael Swango abruptly disappeared. He made his way to Zimbabwe and began medical work at a mission. Again, patients began to die unexpectedly. A few, however, survived to describe being injected by the doctor and within moments suffering paralysis. Eventually, nurses demanded that the chief administrator notify police. A search of Swango's residence revealed multiple drugs and liquid-filled syringes. Swango fled to Zambia and Europe but after a year returned to the United States where he was promptly arrested on charges of fraud. With Swango in jail, the FBI accelerated its investigation. He eventually was sentenced to life without possibility of parole for the murders of three of the Stony Brook patients.

It seems that Swango had used several poisons over the years but most frequently used arsenic to contaminate food or injected potassium chloride. It seems that some of his victims suffered temporary paralysis and recovered to identify him as the perpetrator. Others died quickly. As in the Majors case described below, patient complaints were ignored. (See later discussion of Orville Lynn Majors.)

## **Efren Saldivar**

In the late 1980s, Efren Saldivar was hired as a respiratory therapist at Glendale Adventist Medical Center [13,14]. He was considered competent and knowledgeable of pharmaceuticals and computers. He was assigned to night shift work where he had little supervision. Over time, coworkers began to note that when discussions of patients who needed to die were held, the patients promptly died. Saldivar began to be the common denominator of those deaths. It was not until April of 1997 that one of Saldivar's coworkers reported concerns that he may be injecting patients and killing them. The coworker admittedly did not like Efren, so his complaint was suspect. In one of the few published medical reports detailing a health care serial killer, Andresen and colleagues stated, "In 1998, one staff member finally reported to hospital administrators the suspicion that an unusual number of deaths were occurring at night and on the floors where the subject worked. An internal hospital review was performed, and it was concluded that no data were statistically correlated to any unusual patient deaths at the facility" [13].

A coworker of Saldivar's had made a casual comment to a bar patron about his activity in the hospital. The patron in turn attempted to blackmail the hospital. He had little information but recognized Efren's name. The hospital notified the police. In a bizarre twist, Saldivar admitted to police investigators that he had injected patients to prevent them from suffering. He acknowledged about 50 such acts but later recanted. He also implicated some of his coworkers. Efren's employment was terminated on March 13, 1998. Investigators doggedly pursued physical evidence to support their belief that he was a serial killer. More than 1000 deaths that had occurred during the 8 years Saldivar had been employed were reviewed. The investigators narrowed that list to 20 of the most recent suspicious deaths. Brian Andersen and coworkers at Lawrence Livermore Forensic Science Center in Oakland California were able to demonstrate elevated pancuronium bromide levels in some of the patients [13].

In March of 2002, Saldivar pleaded guilty to six counts of murder and one of attempted murder. He was sentenced to life in prison without parole. It is unclear what agents he used, but in addition to pancuronium bromide, morphine and succinylcholine had been discovered in his locker by coworkers. It seems that at least one coworker was complicit in the murders. Ursula Anderson was given immunity to prosecution for her testimony that she had provided pancuronium bromide to Saldivar with knowledge of his intent to inject patients.

## **Charles Cullen**

Charles Cullen gives us perhaps the best example of how easily a serial killer can drift from institution to institution without detection [6,15]. For

16 years he worked at 10 hospitals in Pennsylvania and New Jersey. He confessed to 30 to 40 murders that he characterized as an attempt to help the victims, but examination of the cases suggests other motives.

By 1992, Cullen was working the night shift in a Pennsylvania hospital. By working nights in the intensive care unit he was in a setting most conducive for killing, with fewer coworkers and sicker patients. In 1993, a patient's son complained to physicians and nurses that a male nurse had given his mother an injection that clearly had not been ordered. He even identified Cullen, but his complaints were ignored. The patient was released the next day and died that afternoon of a suspected myocardial infarction. Her son told the county prosecutor's office that she had been murdered, prompting an autopsy. A generic urine drug screen was negative; however, she was not tested for the presence of digoxin, Cullen's favored poison. He moved to other hospitals where there were several instances of his administering unordered medicines, but these events were never formally documented or communicated to the next employer.

In August of 2002, Cullen's coworkers at St. Luke's Hospital had found procainamide and nitroprusside vials with discarded syringes on a ward where they were not approved for use. The nurses increasingly had been suspicious of Cullen and were concerned that he might be harming patients. In an unusual action they decided to bypass hospital administrators and go straight to the police. Ironically, the police ultimately found nothing for which they could charge him. Two jobs later Cullen was working at Somerset Medical Center in Somerville New Jersey. The computer tracking system for the pharmacy there revealed he had requisitioned unordered drugs for patients who were not assigned to him. One patient died of a myocardial infarction because of digoxin administration. An outside investigator suggested deliberate poisoning but that theory was resisted by the hospital in favor of the assertion that she had been poisoned by herbal tea.

A few weeks later, another patient who had not been under Cullen's care also died. The cause of death was initially believed to be myocardial infarction, but an autopsy revealed digoxin, a drug that was not ordered for the decedent. When a medical toxicologist from the New Jersey Poison Center opined that the hospital had a poisoner, they resisted again. Cullen continued to work while one patient sustained an insulin overdose and a second died of precipitous hypoglycemia. On October 31, Somerset Medical Center fired Cullen for lying on his job application. Following investigation, police arrested him on December 12. He was charged with the murder of Father Florian Gall. Found guilty, he was sentenced to life without parole.

### **Orville Lynn Majors**

A licensed practical nurse (LPN), Lynn Majors joined the Vermillion County Hospital (VCH) staff in the fall of 1993. VCH was a small rural but modern hospital with a dedicated staff. As with most small towns, the

members of the hospital staff knew each other well. When the four-bed critical care unit had patients, Majors would be assigned there to help with a registered nurse (RN) as his supervisor. When the unit was empty, he usually was assigned to pass medications on the medical floor. The admission rate in that ICU consistently had been close to 350 patients annually, with about 27 deaths. In 1993 the rate increased almost imperceptibly, but by the spring of 1994 a climb in those numbers began to draw attention. Rumors reportedly began to circulate that Majors was associated with that increase. By summer of 1994, the increase in ICU cardiopulmonary arrests was noted clearly, and in July the death rate in the ICU began to accelerate. There are conflicting stories as to when the hospital administration became aware and what steps were taken, but in early 1995 the nursing director of the ICU completed a survey comparing the deaths in the ICU for 1993 to 1994 with employee time cards. What she found was of grave concern. Of the 147 deaths in the VCH ICU between May of 1993 and December of 1994, 130 occurred when Lynn Majors was working. In March, VCH officials notified the Indiana State Police of their concerns. Majors was placed on leave and eventually fired. Thus began the largest criminal investigation in Indiana's history. It would last 4 years and cost more than 2 million dollars.

The Indiana State Police assembled an independent medical investigative team that consisted of an emergency physician, an RN, two pathologists, two intensivists, a medical toxicologist, a cardiac electrophysiologist, a cardiac pathologist, and an epidemiologist. For the next 2 years, charts were reviewed on all patients who had died during the time period in question. The thrust of the investigation was to answer two questions for each case: (1) Was the death consistent with the patient's clinical course? (2) If not, was there a person or persons who appeared to be associated with the deaths?

Within a few weeks their review showed that deaths in the ICU commonly followed one of three patterns.

- Sudden onset of hypertension followed by circulatory collapse and cardiac arrest
- Sudden loss of consciousness followed by oxygen desaturation, then dysrhythmia
- Unheralded terminal dysrhythmia with wide complex tachycardia, then asystole

Among the investigative team members it generally was held that more than 100 of the cases appeared suspicious. Majors was in close proximity when death occurred in nearly all of the cases. Eventually, seven cases were selected for trial. Although many more cases were suspected murders, the prosecution team decided that presenting a large number of cases would tend to be confusing to witnesses and the jury.

The investigators determined that Majors had killed the most victims with potassium chloride. Electrocardiogram findings of QRS widening,

P wave changes and sine wave patterns were documented frequently. A search of Majors' van revealed eight vials of potassium chloride, two syringes of epinephrine, and three vials of injectable nitroglycerin. Investigators believe that if Majors worked on the medicine floor he would inject patients with epinephrine intravenously causing a hypertensive crisis and eventually ventricular tachycardia. He would then initiate a code and almost invariably lidocaine would be ordered as part of the resuscitation effort. It is speculated that Majors would then add potassium to the lidocaine infusion or inject potassium directly into the intravenous line. The patient would be moved from the floor to the ICU and Majors would be moved with the patient to staff the area with an RN. In the ICU, he would inject the recruited patient with more intravenous potassium. Amazingly, on one occasion there were three simultaneous cardiac resuscitations in progress in the four-bed ICU. Majors had discovered all three. As with Gene Jones, when Majors took a vacation, the deaths stopped.

Some family members described unusual behavior on Majors' part. In one case he was working with the intravenous fluid bags at the time a family member entered to visit the patient. Majors literally ran from the room almost knocking down the patient's wife. He sat down at the nurses' station and stared into the patient's room. Moments later, the patient gasped and fell back on the bed, unconscious and cyanotic. Though the patient survived the initial resuscitation, the nurse's notes state that he died hours later after suffering a respiratory arrest while on the ventilator!

For all of the resuscitations, only one set of electrolytes was documented. The potassium was 6.8 mEq/L. Probably because the patients were older and no one suspected anything other than natural causes, routine laboratory work, drug screens, and autopsies were almost never done. As a result of the work of the Indiana State Police investigative team, Majors was arrested on December 29, 1997.

In October of 1999, Orville Lynn Majors was sentenced to 180 years in prison for six of the seven murders for which he was tried. Like other serial killers, he had several dedicated supporters, many of whom saw him as a scapegoat. Certain compelling statistics were not allowed to be presented by the prosecution, however. During the investigation, an intense epidemiologic study of VCH was performed. Time cards, vacation dates, and time and date of deaths were reviewed in a blinded fashion. The conclusion of the study by Stephen Lamm, MD, of Washington DC was that the mortality was of "epidemic proportions" from July to December 1994. "Increased mortality occurred in the Intensive Care Unit...One intensive care nurse was uniquely and strongly associated with that mortality...No other service or service provider shows any association that even approximates in magnitude that of the ICU nurse" [16].

The Lamm study concluded: "The likelihood of someone dying in the Intensive Care Unit was 42.96 times greater than it would be if he were not working" [16]. Graphs relating time worked to deaths were also excluded,

leading one police investigator to remark that if the jury had been allowed to see those charts, the trial would have been over in half a day.

## **The common threads**

### *The poisoners*

In most reported cases, the perpetrators are narcissistic. Although they occasionally claim to be euthanizing patients to end their pain, closer scrutiny indicates that there is secondary gain in the form of excitement or a feeling of superiority. Genene Jones, an LVN, frequently performed tasks for which only RNs were qualified. Investigators in the Orville Lynn Majors case speculated that he appeared to try to pass himself as a physician, commonly wearing surgical scrubs and no name tag indicating he was an LPN. Donald Harvey characterized it as follows, “I controlled other people’s lives, whether they lived or died. I had that power to control. After I didn’t get caught for the first fifteen, I thought it was my right. I appointed myself judge, prosecutor and jury. So I played God” [17].

Another striking characteristic is that the poisoners frequently polarized their coworkers, having a few staunch supporters and an equal number of detractors. Often they appeared to be more knowledgeable than others at their level of training, and in most cases assumed tasks or roles greater than their capability. They curried favor with their supervisors, providing a shield for their activity and leading to deflection of criticism as jealousy by their coworkers. A surprising number of serial killers are suspected by coworkers. In general, it is the nursing staff that recognizes the problem first. In many cases physicians and nursing and hospital administrators are so difficult to convince that more deaths occur even after the killer has been identified.

Men are overrepresented among serial killers in the health care system, making up only 7% of all nurses but accounting for 33% of the murderers [18].

Surreptitious behavior often is noted by coworkers or family members. It is remarkable that killers have exhibited bizarre behavior that is noted only in retrospect. Equally impressive is the number of times that lethal injections are made with families present, but the connections between the injection and death are not made.

One of the most frequently asked questions regarding these people is, “Why did they do it?” M. William Phelps, in his account of Kristen Gilbert, *Perfect Poison*, states, “Adults don’t wake up and decide to become serial killers; they are wired at some point—usually during childhood—so that they might later cultivate a malevolence and perpetrate crimes based on what they have been taught” [7].

### *The victims*

For serial killers to operate in a health care setting, selection of victims is important. The very old or very young are most often targeted because they

are unable to communicate. In some cases, the victims may even recognize the perpetrator but are unable to verbalize their fears. Sadly, even when they can, their complaints are disregarded as delusions. In the Majors case, a patient even told his family that a nurse was trying to kill him and that if the family did not take him from the hospital that evening, he would not survive until morning. The family disregarded his concerns and the patient was killed during the night.

When deaths are sudden and unexpected they should raise concern. This especially is true when multiple deaths have occurred. Several things appear to shelter the serial killer in this setting, but the greatest among them is the near refusal to accept that such a heinous thing could occur by a person known to others. For that reason, these deaths often are accepted as natural and not murders. That is particularly true among the elderly. In fact, a common defense for health care serial killers is that the patient was old and sick so death was anticipated. Furthermore, the likelihood of an autopsy being ordered on an 80-year-old patient is much lower than in the young. Even elderly patients almost always have a clinical course that declines before death. Health care workers would do well to ask themselves how many times they have lost patients when death actually was a complete surprise.

### *The method*

Potassium chloride has been a popular drug among serial killers because it is readily available and quick acting. Because of postmortem redistribution, the serum concentration increases rapidly after death. An elevated postmortem potassium concentration is a common finding and of no predictive value in the determination of the pre-mortem level. In recent years efforts have been made by hospitals to avoid accidental administration of potassium chloride. Though seldom reported in medical literature, potassium overdose and death has been a concern in the health care setting [19]. When given surreptitiously, it is unlikely to be treated successfully in resuscitation attempts unless electrolytes are measured. Often overlooked is neuromuscular paralysis that occurs as a result of potassium administration.

Neuromuscular paralytic agents are available in the hospital setting and are not controlled substances. They have rapid onset and appear to induce coma. Patients who survive the exposure, however, frequently can identify the assailant (if they are believed). Laboratory detection is possible but not available rapidly in most hospitals. Kerskes and colleagues [20] described the use of high-performance liquid chromatography-electrospray ionization mass spectrometry for the detection of quaternary nitrogen muscle relaxants such as pancuronium and rocuronium.

Because of its use in homicidal poisoning, the detection of succinylcholine has been the subject of much study. Gao and coworkers [21] were able to detect succinylcholine to a concentration of 0.250 µg/ml in human plasma,

but concentrations may be significantly less than those in postmortem specimens. They applied their method in a patient receiving 1 mg/kg as an IV bolus. The initial plasma concentration of 25.33  $\mu\text{g/ml}$  declined to 0.11  $\mu\text{g/ml}$  in 3 minutes. By 4 minutes, it was undetectable. In postmortem specimens, such attempts at obtaining levels would be of little use.

In 2001 William Sybers, a Florida physician and medical examiner, was found guilty of the first-degree murder of his wife [22]. The conviction was based heavily on laboratory determination that she had been injected with succinylcholine. A method was described to identify the metabolite, succinylmonocholine, as a marker for the neuromuscular paralytic agent. The metabolite is present for a much longer period and was believed to occur only after exposure to succinylcholine and not as an endogenous compound. In February of 2003, Sybers appealed on the basis that the test for succinylmonocholine was new and not accepted as standard medical practice. His appeal won and a new trial was ordered. He subsequently agreed to a plea bargain and was sentenced to 10 years and a \$500,000 fine though he continued to maintain his innocence. He was released on time served for the original conviction. In November of 2003, LeBeau and Quenzer of the FBI Laboratory in Quantico, Virginia, released results of a small study of succinylmonocholine in patients who had not been injected with succinylcholine before death. They were able to identify small concentrations of the compound in autopsy tissue from the six patients they studied. They concluded that, "succinylmonocholine is not an exclusive indicator of exposure to the parent drug, succinylcholine" [23].

Therapeutic doses of succinylcholine result in paralysis that can be managed just by supporting ventilation. Massive doses of that and other paralytic agents may have additional effects not seen at therapeutic doses. For example, larger doses may effect cardiac muscle or potassium concentrations. Prolonged paralysis has been reported [24] but there appear to be other potentially life-threatening effects from paralytic agents, such as hyperkalemia, hyperthermia, or cholinergic activity [25].

Opioids historically have been used widely to murder. These agents are found in wide variety throughout the hospital, but they are controlled. Parenteral administration may occur if the drug can be removed and replaced with water or other liquid. Many undocumented reports exist concerning health care workers who are discovered diverting opioids when patients complain of pain in the face of repeated or high dose analgesic administration. Naloxone, if given in adequate doses, reverses opioid-induced coma. Many health care providers are unaware that opiate screens typically only demonstrate the presence of morphine, codeine, or heroin, with 6-acetyl morphine used to distinguish the latter [26,27]. Oxycodone or hydrocodone occasionally causes positive opiate screens if present in high doses. Synthetic agents, such as meperidine, propoxyphene, or fentanyl derivatives, are not detected on generic opioid screens.

Sedative hypnotics such as benzodiazepines may be used, but seem to be less dependable as lethal agents. Benzodiazepines cause less profound respiratory compromise than opioids or paralytic agents. Veterinary pharmaceuticals also may be used.

Arsenic has long been used in malicious poisonings. Donald Harvey used it to kill patients and Michael Swango used it in an attack on coworkers. For serial killers it has the advantage of lacking a recognizable toxidrome. The initial symptoms are similar to gastroenteritis and the poison can be administered in small doses that have a cumulative and eventually fatal effect. It has the disadvantage of being detectable even in exhumations. In living patients, 24-hour urine specimens are the most useful to demonstrate arsenic. Elevated arsenic concentrations may be found in people who have consumed seafood, but speciation of the type of arsenic can help exclude that [28].

Cyanide allegedly was used by Donald Harvey and Michael Swango. Many other serial killers have used it in the past. Humans are capable of metabolizing small amounts of cyanide, but increasing doses cause symptoms such as altered consciousness, tachypnea, tachycardia, and acidosis. Lethal doses rapidly produce respiratory arrest [29]. There are disadvantages to its use as a lethal agent, however. It is difficult to obtain. Incorrect usage can injure the perpetrator, and it is believed that some people are capable of detecting its odor on the death of victims. The evidence for that is scant, though some authors note wide variation in humans' ability to detect the bitter almond odor [3]. Laboratory detection usually is available at reference laboratories but not in hospitals. One concern about cyanide analysis is that whole blood concentrations, although widely used, may not be as reliable as red cell or plasma cyanide concentrations. Vesey and Wilson [30] reported significant artifactual cyanide formation because acidification during the test caused cyanide production from thiocyanate. Plasma or red blood cell cyanide analysis is recommended, therefore, when cyanide poisoning is suspected [29].

### *Laboratory studies*

Laboratory studies have a limited but critical role in the detection of health care serial killers. They also play an important role in their prosecution. A major deficiency is the inaccuracy of postmortem urine or serum concentrations in predicting pre-mortem concentrations. Several reports of postmortem redistribution of drugs demonstrate that many drugs shift from internal organs back into central circulation after death. Postmortem blood collection from large thoracic vessels or the heart may be several times higher in concentration than blood collected from the femoral or other peripheral vessels [31].

Blood chemistries also are variable. Although some electrolytes, such as sodium or chloride, decline postmortem, potassium begins to climb within an hour after death [32–35]. This information was derived from comparing

postmortem electrolyte concentrations with pre-mortem concentrations obtained a short time before death.

Unfortunately, many of the specimens examined in investigations of suspected serial killings are obtained following exhumation. These materials generally are much less revealing of toxins but have some usefulness. In a review of their experience and the previous medical literature, Grellner and Glenewinkel [36] cite 40 pharmaceutical agents that have been recovered by postmortem sampling and the interval between death and testing. Neuromuscular paralytic agents are among compounds successfully recovered [37].

### *The institution*

A chillingly consistent practice in hospitals where serial killers have operated is the slow response of administrators and physicians to involve the police. This seems to be because of a fear of litigation and potential adverse media coverage, but sadly costs more patient lives. Health care providers and administrators are neither trained nor appropriate to conduct investigations of suspected homicides.

Hospital mortality committees are required to provide surveillance of deaths that occur. Variations in mortality rates must be explored, not simply excused. There are several factors that can indicate or contribute to a potential problem.

### *Deaths occur around meal times*

As Donald Harvey noted, that is a time when half of the nursing staff is off the unit. The remaining staff members are busy in other rooms leaving many patients unattended.

### *Deaths occur in 24-hour cycles (same shift)*

This was noted with Kristen Gilbert and Orville Lynn Majors. In addition, vacation times often correspond to cessation of codes and deaths, as seen with Geneene Jones and Lynn Majors.

### *Deaths do not follow glide slope*

Before typical natural death a progressive decline in clinical course often predicts the outcome. This decline can be subtle in the elderly or the critically ill. Patients usually show a clinical decline in advance of terminal events, whereas murdered patients have abrupt arrests.

### *Poor success rates in codes*

The immediate survival rate of in-hospital codes is 44% with 17% finally living to leave the hospital. Success rates appear to be lower when a serial killer is at work. In a review of 14,720 cardiac arrests in 207 hospitals, Peberdy and colleagues [38] found the most common causes were cardiac

arrhythmias, acute respiratory insufficiency, and hypotension. Resuscitation teams have to assume that they are working with the most common causes of cardiac arrest. They seldom have the time to determine and correct the cause of the arrest if an unknown toxin is at work.

#### *Evidence of uncharted injections*

Although this is a factor that is difficult to find during a routine chart review it deserves notation. In-hospital poisonings generally are administered orally or more often intravenously. Because the perpetrator usually is the person charting, injections of unordered medicines are undocumented. Discovery of needle marks, witness reports of injections, or questionable discarded medications should be checked against physicians' orders and nursing notes.

#### *Medications frequently come from the hospital*

In several cases, the hospital pharmacy or medications on the wards serve as the source for the serial killer's poison. This is because not only are the medications easy to procure but also many of these medications do not show up on routine drug screens. Serum potassium concentration begins to increase shortly after death making it an unreliable indicator of pre-mortem potassium concentration. Neuromuscular paralytic drugs, another frequent choice of agents, are not found by a drug screen and require specific testing that generally is beyond the ability of most hospital laboratories.

Although state laws prescribe certain circumstances that mandate a coroner's case, an autopsy is not necessarily performed even in those circumstances. Particularly, deaths of elderly patients are considered natural simply because of their age. As in the Major's case, out of 140 deaths none had postmortem examinations unless they were exhumed as part of the investigation. As Donald Harvey put it, "I could have been apprehended with the first one if they had done the autopsy" [2].

If a patient death is not consistent with the patient's clinical course, an autopsy is imperative. If the autopsy is not consistent with the reported medical conditions, homicide should be in the differential diagnosis. Physicians have an obligation to report concerns to the coroner's or medical examiner's office.

#### *Patient complaints ignored*

Unfortunately, this almost always is found in retrospect. Remarkably, even the victims are often unaware that they are being abused.

#### *Employee suspicions ignored*

Almost without exception, it is the killer's coworkers who discover their activity. In case after case, physicians and administrators discount reports and denigrate whistle-blowers.

### *Poor cross-communication among hospitals*

Probably the most effective approach to this problem is better communication between hospitals and pre-employment screening to look for potential problems.

### Summary

Numerous health care professionals have been found guilty of murdering their patients. These perpetrators used various poisons to kill their victims. Even though each of these murderers was unique in how he or she killed, several common characteristics have been noted regarding these cases that should heighten health care workers' and administrators' concern of potential foul play.

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