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Role of Forensics in the Cases of Criminal Poisoning

Siniša Franjić[1]

[1]Faculty of Law, International University of Brcko District, Brcko, Bosnia and Herzegovina

Correspondence: Siniša Franjić, Faculty of Law, International University of Brcko District, Brcko, Bosnia and Herzegovina. E-mail: sinisa.franjic@gmail.com

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Abstract
Forensics is a scientific discipline which deals with evidencing of criminal acts, and consists of a series of sub disciplines. One of them is forensic toxicology whose task is to detect the existence of poisons in the human body and existence of poisons in all areas where they should not be. Although rarely happens, the criminal act of Poisoning has to be investigated in accordance with the rules of criminal investigation and, due to the established facts, to raise the indictment and punish the perpetrator.

Keywords: Poison, Forensics, Forensic Toxicology, Perpetrator.

1. Introduction
Criminal homicidal poisoning is a murder in which poison is the murder weapon [1]. Poisoning homicides are rare and in some cases likely go undetected. There are a total of about 16,000 homicide deaths reported per year in the United States, and less than 1% of these are the result of intentional poisoning. As the symptoms of poisoning are often difficult to distinguish from those of natural diseases, intentional poisoning deaths can be easily misdiagnosed or attributed to an acute illness. Homicide poisoning deaths can also appear to be accidental or due to suicidal behavior. Beyond the difficulty in diagnosing poisoning deaths, the circumstances surrounding the death may include false information provided by the perpetrator of the crime.
Homicidal poisoning is difficult to investigate and often requires advanced technology and skills, and a significant commitment of investigative resources.
Poisons are neither difficult to obtain nor difficult to administer. Novels and television shows often present plausible poisoning scenarios with sufficient detail for individuals to adapt to real-life situations. Fictional poisoning cases generally identify flaws in the murder plan that ultimately leads to the identification and prosecution of the murderer. Some individuals could understandably reason that they could successfully implement the plan if they avoided those flaws.
Poisoning is the damage to the health of the organism caused by poisons [2]. By the time they are different, they are acute and chronic, and the consequences are deadly and not deadly. Motive of poisoning can be murderous, suicidal and accidental. Injuries of the human body to poisons fall into chemical injuries. Poison is difficult to define because some substance must have a variety of properties to be considered poison. It can have a therapeutic character and a toxic character, all the way to the deadly dose. Everything depends on the dose, not the chemical composition of the drug, as well as the path of entry into the body.
For centuries, poisoning has been a popular way to do away with a known rival [3]. History has shown poisoning to be the method of choice for women who want to commit murder, perhaps due to the perceived nonviolent nature of the act. Little or no blood is shed, poisoning often mimics a natural disease, and the victims often do not know they are being poisoned. However, the demographics have changed somewhat, and males are now just as likely to murder by poison. Almost any natural substance in the right dose can be toxic and many cause symptoms that are nonspecific, appearing to be common diseases, leading to the belief that the victim died of natural causes.

2. Poisons

Individual substances used for poisoning homicides have distinguishing properties such as how quickly they act, the symptoms they produce prior to death, and their analytical detectability [1]. These characteristics can provide useful information for investigative purposes. However, sometimes poisons are selected without any consideration of their toxicological features. A rodenticide, for example, might be used to poison someone because it was, in fact,identified on the label as a poison. A particular poison might also be chosen because it happened to be easily accessible. For example, poisoning with therapeutic medications might be selected with little regard for specific mechanisms.

The circumstances surrounding an individual‟s death are important determinants in establishing the cause and manner of suspected poisoning deaths. In some cases, a retrospective examination of a decedent‟s medical history can be enlightening. Some poisoners are known to have experimented with various doses as well as with individual poisons prior to an exposure with a fatal outcome. There could be a history of illness occurring at irregular intervals that reflect this. The illness might have been unexplained or diagnosed as a disease.

Poisonings most frequently involve premeditation and a degree of planning. However, there are cases in which planning might occur rather quickly and the poisoning is somewhat impulsive. For example, someone might simply decide to kill someone and use a convenient poison, such as a rodenticide, as he or she is preparing a meal. Also, individuals may have considered how they might poison someone as a random thought while they were watching television or reading a novel and then, perhaps years later, they encountered some situation or opportunity and acted on that thought.

Poisoning, one of the oldest methods of murder, can occur from an overwhelming dose that causes immediate death or from small doses that accumulate over time and cause death [4]. Poisons can be injected into the blood or muscles, inhaled as gases, absorbed through the skin surface, taken in foods or liquids or inserted into the rectum or vagina.

Homicidal poisoning can be accomplished with any one of thousands of substances, but some are far more common than others. Among the most commonly used is arsenic, known as the King of Poisons and the Poison of Kings. Cyanide, also commonly used, is a favorite in mass homicides, suicides and politically motivated killings. Strychnine, given in large enough doses, produces “a dramatic and horrifying death with the victim‟s body frozen in midconvulsion, eyes wide open”. Experts in toxicology (the study of poisons)can determine the type of poison, the amount ingested, the approximate time ingested and the effect on the body.

Criminal homicidal poisoning is a murder in which poison is the murder weapon [5]. Poisoning homicides are rare and in some cases likely go undetected. There are a total of about 16,000 homicide deaths reported per year in the United States, and less than 1% of these are the result of intentional poisoning. As the symptoms of poisoning are often difficult to distinguish from those of natural diseases, intentional poisoning deaths can be easily misdiagnosed or attributed to an acute illness. Homicide poisoning deaths can also appear to be accidental or due to suicidal behavior. Beyond the difficulty in diagnosing poisoning deaths, the circumstances surrounding the death may include false information provided by the perpetrator of the crime.

3. Profile of Perpetrator

Poisoners are frequently characterized as individuals who are cunning, sneaky, and creative, have superior intelligence, and are likely to be females [1]. These descriptors may very well fit some poisoners, but many poisoners tend to be individuals with ordinary skills and average intelligence. They do not seem to preferentially select exotic or rare substances for poisoning. They usually poison individuals they know or with whom they are in some way connected. Probably the most generalizable feature of poisoners is the desire to eliminate someone for an identifiable reason without being caught. It is especially important to apprehend the individual responsible because of the real possibility that, because a poisoning murder goes undetected, the poisoner gains confidence from the success and later poisons another person.

Identifying the perpetrator is, of course, the primary goal of a criminal investigation, but the ability to bring a suspect to justice also depends on the evidence necessary for conviction [6]. This may take many forms, including physical evidence linking the suspect to the scene (fingerprints, blood, DNA, toolmarks); possession of evidence from the scene (property, fibers, hair); physical identification (tattoos, deformities, physical descriptors); and eyewitness descriptions, which, incidentally, have proven to be highly unreliable when the suspect is not known to victims or witnesses. Modus operandi, or method of operation, is also an important consideration.

In addition to the identification of the perpetrator from records, physical evidence, and eyewitnesses, the value of motive must be examined. Certain crimes, such as burglary, robbery, and rape, seem to have a universal motive; others, such as homicide, arson, and assault, have what might be called “particularized motives,” because they often relate victim to criminal. Once established, it would be practical to develop a short list of persons who might have a

particularized motive; then, if the investigator considers who had the opportunity and the temperament to carry out the crime, one or perhaps a few suspects may
remain on the list. When physical evidence is available, as it often is in these crimes, this extends the possibility of a solution beyond what can be accomplished by interrogation alone.
If a poisoner can convince others that the cause of the victim‟s death is natural or has an explanation not implicating the perpetrator, rigorous investigation may be circumvented [7]. Physicians have to be alert to apparent symptoms of illness or disease being in fact indications of poisoning. Strychnine causes violent convulsions that can be mistaken for epilepsy. Symptoms of arsenic poisoning mimic heat stroke or cholera and can be mistaken by physicians unfamiliar with the distinctions. At the scene, there may be transitory indications which if unnoticed there may be lost. An odour on the victim might suggest a poison, as with nicotine poisoning leaving a tobacco smell. A cherry red skin colour of the deceased might indicate carbon monoxide poisoning. Death certification procedures aim to provide safeguards, but much depends on the rigor of the procedures and on participants not „cutting corners‟.

4. Forensics

Forensic Chemistry is an integral part of a relatively new discipline, Forensic Science [8]. The definition of this discipline is still under discussion and varies from country to country and even between local regions. Etymologically the word "forensic" is derived from latin "forensis" (public), which is related to "forum" (market place) where roman courts originally had their sessions. "Forensic" today can be defined as "related to court procedures". The second part of the expression "Forensic Science" is not as clearly defined. It is generally agreed on that legal medicine, criminalistics, and legal toxicology belong to its domain. The situation for legally oriented sociology (criminology) and the whole field of law is less clear and opinions about whether or not to regard these disciplines as parts of forensic science vary geographically and temporally.
By tradition and training, the legal medical expert encompasses most of the medico-legal disciplines such as pathology, histology and psychiatry - but he often also extends his work to forensic serology, toxicology, osteology and odontology.
The forensic science laboratories concern themselves with all or parts of criminalistics, but traditionally with the laboratory aspects of ballistics, tool mark investigation, questioned document work, arson and trace evidence investigation.

5. Forensic Toxicologist

Toxicologists detect and identify drugs and poisons (toxins) in bodily fluids, tissues, and organs [9]. Samples may include a vial of drawn blood from a suspect in a DUI case, whole blood and urine samples from the victim of a sexual assault who reports being given a drug, or fluid and hair samples obtained from deceased victims in suspected overdose orhomicidal poisoning cases. Similar to drug identification testing, analysts employ a series of screening and confirmatory tests to identify the chemical structure, or signature, of substances. As the human body is an active chemistry laboratory, few substances enter and completely leave the body in the same chemical state; therefore, a thorough understanding of how the body alters and metabolizes the chemical structure of a drug is essential to detecting its presence in appropriately collected samples.
The forensic toxicologist is expected to detect and identify poisons, but if „poison‟ is defined as a chemical substance harmful to living organisms; it is obvious that „harmfulness‟ is not a property that can be measured by any chemical method of analysis [10]. Toxicity is a biological concept, usually determined by some form of bioassay, but bioassays are hardly ever used now in forensic toxicology. Chemical analyses are used to detect the presence of the poison, measure its concentration and relate this to its known toxicity. If the poison is not specified by name, the request to „test for poisons‟ becomes a major problem for the chemist, because no single chemical method of analysis is able to detect all the various poisons. At least seven different analytical schemes are required to exclude even the most commonly encountered poisons. Compared with toxicologists in academic research or industry, the task of the forensic toxicologist is made more difficult because the analytical material, the available time and the resources are all severely limited. The forensic toxicologist has scarcely any control over the sampling time or the selection of material submitted for analysis, and has no certain knowledge that a poison is present.
Apart from these analytical problems, the legal aspect of the work demands a scrupulous attention to detail. Failure to make full descriptive notes on the items received, a simple error in the date on which the analysis was performed, or neglecting to record weighing or to check one’s calculations or reagent purity can become evidence of careless work in the hands of an astute lawyer. The lawyer may, with justification, explore the extent of the toxicologist’s experience and knowledge, demand a detailed account of the analytical methods and challenge the integrity of any opinion. The crucial evidence of identification and quantification of the poison may be faultless and the conclusions maybe correct, but if the court’s confidence in the forensic toxicologist as an unbiased scientific expert is destroyed, the case may be lost. A secure chain of custody of all the exhibits submitted also has to be demonstrated.

The analysis of whether a crime scene appears organized or disorganized can often yield valuable information about the mind-set of the killer [11]. The poisoner usually will exhibit some characteristics of both the organized and disorganized personality. The organized poisoner has a planned offense and usually leaves no weapon or evidence at the crime scene. By contrast, the disorganized poisoner leaves the evidence in plain view at the death scene.

The criminal investigator needs to look carefully at the death scene to answer the following important questions: Does the body disposition show the possibility of an unnatural death? Are there items intentionally left or strangely missing? Are there any unusual odors? Investigators must remember to be aware of the masking effect of tobacco smoke on unusual odors associated with some poisons (e.g., cyanide, solvents, and fumes) and not allow smoking at the crime scene. Finally, is there evidence of "staging" (purposeful alteration of the crime scene)? It must be kept in mind that with the poisoner the scene will be left mostly in a natural state, except that the vehicle for administering the poison may have been removed or cleaned. As the famous French forensic scientist Dr. Edmond Locard (1877-1966) taught, "Every contact leaves a trace." This is now known as Locard's Exchange Principle. Special care is taken to identify any preexisting conditions or malformations in the organs that might have contributed to the death of the victim [12]. Pulmonary edema (fluid accumulation in the lungs) is frequently found in victims of chronic cocaine and amphetamine abuse. Heart malformations may cause suspicious death in an otherwise healthy individual.

Special attention is paid to the digestive tract if poisoning is suspected. The stomach can show partially digested or dissolved pills. Chemical analyses can also be carried out to show signs of poisoning. The amount of pills or tablets in the stomach can aid in the determination of manner of death as well. It is not always a sure sign, but typically it is unlikely that a person will accidentally swallow a large number of pills. This would suggest suicide rather than an accidental overdose. Stomach contents may reveal the deceased's last meal. The extent of digestion can help with determining the time of death.

6. Forensic Toxicology

Forensic toxicology is the study of toxins (drugs, medications, and other foreign substances) and their detection in and effect on the human organism in a legal context, thus making it a field of forensic medicine [13]. Its areas of application mainly include the investigation of poisoning in living subjects and fatalities (postmortem toxicology), as well as drug and medication abuse. Other subfields of toxicology include food toxicology, industrial toxicology, environmental toxicology, and radiation toxicology.

The term „forensic toxicology covers any application of the science and study of poisons to the elucidation of questions that occur in judicial proceedings [14]. The subject is usually associated with work for the police, the coroner and the criminal law courts. However, the analysis and identification of medicines and the maintenance of agricultural, industrial and public health legislation (to ensure clean air, pure water and safe food supplies) are also aspects of forensic toxicology, although usually associated with civil courts rather than criminal courts. Like the forensic toxicologist in criminal cases, analysts employed in these civil areas may at times find their work subject to severe public scrutiny in a law court, and both groups should be aware of the strengths and limitations of each other's methodology.

The defining difference between the clinical toxicologist and the forensic toxicologist is the judicial element. The samples taken for analysis and the techniques used to detect and identify poisons are generally similar for both clinical and forensic toxicology. The clinical toxicologist is primarily concerned with the identification of drugs and poisons as an aid to the diagnosis and treatment of acute and chronic poisoning. If the patient dies, the analytical data obtained by the clinical toxicologist may well be sufficient for use by the pathologist and the coroner in determining the cause of death in cases where there are no suspicious circumstances. In other cases, including those where the patient recovers but claims to have been poisoned by a third party, it is usual for the investigation to be referred to a forensic toxicologist.

Although the above indicates that the forensic toxicologist is generally involved in cases of suspected poisoning, more recently other roles have developed in areas such as doping in sports, of both humans and animals, and workplace drug testing. The question to be answered in these areas is not „Has this person been poisoned?", or at least not in the conventional sense where poisoning is taken to mean harm having been induced. Instead, such questions as „Has a drug or poison been administered which might affect performance?" or „Is this person taking an illegal substance?" may need to be investigated.

7. Crime Scene Investigation

It may seem redundant, but crime scenes exist whenever a crime has been committed [15]. It could be at the location of the "boiler room" telephone scam artist or at the home or office of a person sending threatening hate mail or e-

mail, but more than likely the professional investigator will encounter crime scenes where a violent act or financially significant theft has occurred.

Investigations at crime scenes can generally be broken down into five areas: (1) security and safety, (2) documentation and collection of evidence, (3) detention, segregation and interview of witnesses, suspects, or persons already under arrest, (4) canvass for additional witnesses, and (5) exiting.

8. Identification of Perpetrator

Before the police begin to search for a suspect, they should have obtained from the doctor and toxicologist details about the type of poison used the amount of concentration, and how it was introduced into the victim [16]. This information will help the police plan the direction for their investigation.

To help identify potential suspects, police should focus primarily on those who have had access to the victim, particularly ones who have something to gain. In cases of assisted suicide (which some states regard as murder), what is often gained is a peaceful death for a terminally ill patient. Excluding these cases and those that are considered negligent homicides, the motivations for homicidal poisonings may be financial (insurance or inheritance), personal (revenge for a perceived wrong), or psychological (a desire for power and control).

Most poisoning cases require that an offender have access to the victim. Thus, investigation should focus on those within close proximity. All family and friends having access should be viewed as potential suspects regardless of their age, occupation, or status. Experience has consistently shown that even the most trusted members of families and communities may have a “secret” side. While this does not make them a murderer, it means that police should explore the backgrounds of all potential suspects, looking for motive, means, and opportunity.

9. Forensic Evidence

The importance of forensic science to criminal law lies in its potential to supply vital information about how a crime was committed and who committed it [17]. The information may survive the screening function of the rules of Evidence and be accepted as evidence of a material fact in the ensuing trial. Evidence is simply court-approved information that the trier of fact, typically a jury, is allowed to consider when determining a defendant‟s guilt or innocence.The admissibility or inadmissibility of trial information, whether eyewitness testimony, photographs, physical objects, or scientifically-generated information, such as DNA, is determined by the trial court‟s application of the rules of Evidence. This set of evidentiary rules are basically exclusionary in nature, that is, they filter out information presented by either side that may be irrelevant to the factual and legal issues at hand, or that
violate longstanding prohibitions such as those against the admissibility of hearsay or substantially prejudicial information.

Analysis of blood is one of the most widely used interpretative specimens of toxicology analysis [18]. It is particularly useful for the interpretation of drug levels and their metabolites in postmortem and human performance forensic toxicology. For example, blood can be used to determine whether an individual was under the influence of alcohol or other drugs while operating a motor vehicle. A blood analysis can also provide valuable information in postmortem cases, such as the effect of a drug at the time of death or in cases of suspected drug overdose and poisoning.

10. Conclusion

When considering the criminal act of poisoning from a forensic perspective, it should be noted that the criminal investigation is conducted in two directions. In the first case, it is necessary to find out what kind of damage has been caused and what the poison is doing, and in the other it is necessary to find out who is the perpetrator and which are his or her motives. Poisoning does not always end with death, but a victim of poisoning can have permanent health consequences. This means that criminal investigation of poisoning is a very complex procedure involving experts from different profiles. The surviving victim of poisoning has to resort to medical treatment within which the therapy will depend on the damage to the organism. Depending on the degree of damage to the organism, recovery may take some time.

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