

THE ROLE OF THE CORONER

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INTRODUCTION

The coroner's office is responsible for medicolegal investigations of deaths within its geographic jurisdiction, which include determining the time, cause, and manner of death, and the identity of the decedent. The coroner's office is required by law to investigate all deaths that are sudden, unexpected, and unattended, as well as all suicides, homicides, and accidental deaths.

In the Commonwealth of Pennsylvania, coroners are elected for a four-year term. As an elected official the coroner is fully accountable to the electorate, but there is no required training or background to run for the office, and the majority of coroners are not physicians. Medical training helps in deciphering complex medical records and understanding the pathophysiology responsible for death, and coroners may utilize the services of a forensic pathologist to perform autopsies and assist in determining the cause and manner of death. Death investigators who perform investigations and research at the scene provide the coroner essential information critical to completion of death investigations. Additional expertise is provided by other specialists within the office, including forensic odontologists, entomologists, and anthropologists.

CAUSE AND MANNER OF DEATH

Determination of the cause and manner of death is among the most important functions of the coroner's office. The cause of death is the process, injury, or disease that is primarily responsible for that individual's demise, such as myocardial infarction, carcinoma of the lung, gunshot wound to the head, or multiple traumatic injuries.

When called to investigate a death, the investigator will very carefully examine the entire death scene for clues and evidence as to what may have caused or contributed to the death of that individual. Any witnesses to the death are interviewed and - when appropriate - family members and individuals who have had close contact with the decedent are also interviewed. If death is thought to be due to a medical

problem, the decedent's physicians are contacted for any relevant information they can provide. Medical records are obtained and reviewed. The coroner also has subpoena power to obtain necessary records and to interview those who may be reluctant to discuss the details of the death.

If investigation of the scene does not provide adequate information to determine a competent cause of death, the coroner may order an autopsy to assist in making that determination. An autopsy is performed at the County's expense, and cannot be refused by family or next of kin if the autopsy is deemed necessary by the coroner. Conversely, if the coroner is able to determine the cause of death without an autopsy, family members and next of kin may not compel the coroner to perform an autopsy. Family members who wish to have an autopsy performed may have one performed at their own expense by a forensic pathologist of their choosing. Next of kin may also have their family member re-autopsied at their expense if they wish a second opinion or do not agree with the initial autopsy findings.

The manner of death is defined as the way that death occurred. Aside from natural deaths, manners of death include homicide, suicide, accidental, undetermined, and pending further investigation. Of course, the vast majority of deaths are natural, in which case the treating physician may complete the death certificate and determine the cause of death. These causes must reflect the underlying disease process responsible for that individual's demise; general mechanisms such as "cardiopulmonary arrest" or "cardiac arrest" are inappropriate as causes of death and should never be used.

Determination of all other manners of death may only be made by the office of the coroner. A homicide is a death at the hand of another; suicide is a death at one's own hand. An accidental death may be the result of an unintentional physical injury or ingestion of a noxious substance. If no manner of death can be identified after comprehensive investigation, the coroner

may list the death as undetermined.

The manner of death should be listed as the root cause of death. A man who dies from urosepsis caused by an indwelling Foley catheter 40 years after an automobile accident that rendered him paraplegic, is a coroner's case, and the death is ruled accidental. Similarly, a woman who dies of a pulmonary embolus, but had been rendered paraplegic by an assailant's gunshot wound, may be ruled a homicide. If not for the gunshot wound she would not have been immobile, and she would not have developed deep venous thrombosis and a pulmonary embolus.

Deaths that result from injuries that are self-sustained and are not suicides are generally accidental. Deaths occurring subsequent to those injuries as direct or indirect consequences are also accidental. By example, if an elderly individual falls and sustains a hip fracture and dies weeks later as the result of the debility that resulted from that fall, the manner of death is accidental and that determination may only be made by the coroner, not by the treating physician.

If additional information becomes available which impacts the circumstances of death, the coroner has the power to issue a death certificate with a changed cause and/or manner that supersedes any death certificate filed previously, whether it had been issued by the coroner or anyone else at any time in the past, within that coroner's jurisdiction. When appropriate, the coroner even has the right to reissue death certificates from centuries ago.

If a death is determined to be natural and a plausible and likely cause of death can be identified, a definitive cause of death need not be identified. As an example, if a 78-year-old male with a history of diabetes, hypertension, hyperlipidemia, and other comorbidities dies unexpectedly in his sleep, a cause of death of ASCVD and a natural manner of death may be ruled without subjecting the decedent to an autopsy or more intensive and aggressive investigation.

IDENTIFICATION

The coroner's office is ultimately responsible for the identification of all decedents in jurisdictional investigations. Visual identification by family members or by a photograph of a recently deceased, intact, and non-decomposed individual may be acceptable. If there is any question about the identity of an individual, unique markers (i.e. tattoos) may be utilized. If the individual has been previously fingerprinted, fingerprint identification is acceptable and accurate.

If questions of identification remain, particularly in individuals who are decomposed or were subjected to severe thermal injury, dental records are utilized. If dental records are unavailable, DNA is sent for analysis.

Identification of remains provides a substantial challenge to the coroner when there is severe decomposition, particularly in circumstances where only skeletonized remains are recovered. Radiologic examination may provide clues, particularly if previous X-rays are available for comparison. A forensic anthropologist can examine skeletal remains and provide important identifying demographic information which can narrow the search, such as gender, approximate age, height, body build, and the existence of disease processes or prior accidents and injuries. That same information can be entered into national data banks for missing individuals such as NAMUS, the National Missing and Unidentified System. By entering appropriate demographic information, the investigating coroner obtains international exposure to assist in identifying the remains.

NCIC, the National Crime Information Center, is a computerized index of criminal justice information (i.e. criminal record history information, fugitives, stolen properties, missing persons) that is made available by the FBI 24/7 to federal, state, and local law enforcement and other criminal justice agencies. It is also utilized to enter demographic information for the purposes of identification. In challenging cases, various supplemental methods can assist efforts at identification: forensic artists can create sketches of the decedent based on anthropologic findings; other forensic artists can create clay renderings of decedents based on the same findings; and sketches and sculptures can be widely publicized in an effort to engage the general public in efforts to identify individuals.

The coroner's office is also frequently called to determine recovered skeletal remains are of human or nonhuman origin. Though this is sometimes a straightforward and easy determination, there are circumstances where this analysis is far more challenging. As an example, our office was called to identify whether or not a human-appearing skinned and sawed off ankle was indeed of human origin. As one might imagine, the possibility of the existence of a dismembered human being was of substantial concern. X-rays and careful anthropologic comparative vertebrate evaluation revealed the ankle to be that of a bear, which has a striking resemblance to a human ankle. Further

investigation revealed that a local taxidermist had removed the ankles and feet of a bear and disposed of them in a nearby wooded area.

DETERMINATION OF POSTMORTEM INTERVAL

The coroner's office is ultimately responsible for the determination of time of death. This can be very straightforward if there are qualified witnesses and the death is recent, but it is far more challenging if the time of death is more distant and significant decomposition has occurred. It is often impossible to provide more than a range of the interval during which death likely occurred.

Livor mortis is the reddish coloration of the skin that occurs postmortem in the dependent areas of the body as the result of blood pooling in the small blood vessels of the skin. This begins to occur within 1 to 2 hours of death and continues to become more pronounced with time. Ten to 12 hours after death, livor mortis becomes "fixed," meaning that this coloration will not blanch with digital compression and will not move with changes in body position. In addition to livor mortis's use in determining the time of death, it can also be used to determine whether the body has been moved. Claims that a body has not been disturbed since death can be refuted if livor mortis is identified in nondependent parts of the body.

Rigor mortis is the stiffening of muscles of the body that occurs after the death of an individual. It generally begins within 2 to 3 hours of death and is fully manifested 10 to 12 hours after death. It may develop much more rapidly in febrile individuals, in individuals who were engaged in significant physical exertion immediately prior to death, and in individuals who drown. Like livor mortis, rigor mortis can also suggest whether an individual has been moved. Unusual or unnatural posturing always prompts further investigation. At variable times beginning more than 24 hours after death, rigor mortis begins to recede and disappears as decomposition becomes more manifest.

Algor mortis is the progressive cooling of the body after death. It can also be utilized to estimate the time of death, but there are many variables that influence algor mortis. At room temperature, the body cools at a rate of 1° to 2°F per hour for the first 12 hours, then approximately 1°F per hour until the body reaches the ambient environmental temperature. Cooling is twice as rapid in water than in air and this factor must be considered when bodies are recovered from water. Febrile illnesses secondary to infectious processes can

actually cause an increase rather than a decrease in body temperature for the first few hours. Other factors, including hyperthyroidism, vigorous exercise, certain drugs, seizures, and high ambient temperature all can cause an increase in body temperature and must be taken into consideration when using algor mortis to determine postmortem interval.

Decomposition begins at death and is accelerated or decelerated by the environment in which death occurred and in which the body remained. Autolysis is the destruction of cells as the result of intracellular enzymes that are released after death. Putrefaction is decomposition that results from tissue destruction caused by bacteria within and outside of the body. Cool and dry environments slow decomposition, whereas warm and moist environments accelerate it. Taking these environmental factors into account, the degree of decomposition can be helpful in determining the time of death. With advanced decomposition, a forensic entomologist can correlate insect activity (specific species of insects, eggs, and larvae) with specific postmortem intervals.

AUTHORIZATION FOR CREMATION AND THE RELEASE OF ANATOMIC GIFTS

Specific authorization by the coroner is required before proceeding with cremation or release of human remains for anatomic study, in case further investigation might be necessary to rule out an unnatural cause of death, particularly foul play. A death certificate certifying the death of an elderly individual with multiple comorbidities will require little investigation before approval is granted. A younger individual without medical problems in whom a nonspecific cause of death had been assigned will likely require a full investigation, possibly with autopsy, before a plausible cause and manner of death is assigned and an authorization is provided to proceed with cremation or anatomic donation.

Similarly, approval of the coroner is required for donation of tissue or organs to organ procurement organizations in all cases that fall under the coroner's jurisdiction. Infrequently, approval may be withheld if the cause and manner of death are uncertain and possibly suspicious, or if an autopsy is necessary for the successful prosecution of a homicide.

CRIME SCENES

The coroner's office must work closely with law enforcement authorities, as both jurisdictions are

called to death scenes. Law enforcement is responsible for conducting criminal investigations in all suspicious deaths, whereas the coroner is responsible for conducting medicolegal investigations to determine the cause and manner of jurisdictional deaths.

At crime scenes, law-enforcement has full jurisdiction of the entire scene excluding the decedent. Law enforcement will determine how, when, and where the coroner may enter the scene. By statute, the scene remains untouched until the coroner has had a full view of it. Often, the coroner will enter the scene by a specified route to make a determination of the postmortem interval, then will back out to allow law enforcement to document the scene and gather evidence. The body may not be touched or moved until the coroner re-enters the scene and fully examines the decedent, after which the remains are transported to our forensic center for further investigation.

Law enforcement is invited to attend autopsies in criminal cases, and accept evidence that the coroner's office collects from the decedent at postmortem examination. Prior to the performance of these autopsies, the coroner, forensic pathologist, death investigators, and detectives meet to discuss details of the death, the criminal investigations, available records, and review scene photographs, so that the autopsies performed are more targeted and comprehensive.

NEW FORENSIC TOOLS

Genomic testing is utilized selectively to help determine the cause of death. Perhaps its greatest utility is in child and infant deaths that are unanticipated,

unexplained, and otherwise undetermined. As an example, channelopathies, which may cause fatal dysrhythmias, may be identified by genomic testing. In addition to providing desperately sought answers to grieving parents, genomic testing can also identify genetic conditions that place survivors at risk. Our office obtains blood samples on all individuals brought in for autopsies so that genetic material is available for analysis if needed at some point in future.

CT scanning will expand our capacity to perform death investigations. Some investigations may be disposed of conclusively by utilizing a CT scan, allowing more prompt release of decedents to their families and, in some cases, avoiding an autopsy. Currently, CT scanning is used in a focused way to provide specific answers, and may be a substitute for an autopsy if cause and manner of death can be determined from the CT scan. The role of "virtual autopsies" if cause and manner are completely unclear has yet to be determined.

CONCLUSION

The office of the coroner provides answers about the cause, manner, and timing of death in jurisdictional cases. The coroner's office will continue to work closely with individuals in the community, particularly those in health care and law enforcement, to perform those investigations effectively. New methodologies will be utilized to enhance our capacity to provide answers to grieving families and to provide law enforcement with information necessary for successful prosecutions.

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