

CASE REPORT**PATHOLOGY/BIOLOGY**

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Philemon and Baucis Deaths: Case Reports and Postmortem Biochemistry Contribution

ABSTRACT: The death of a person as a reaction to the death of another is known as Philemon and Baucis death and may represent a difficult challenge for pathologists, especially due to the decompositional changes that often characterized these situations. In this article, we describe two cases of Philemon and Baucis deaths, the first concerning a married couple and the second concerning a father and son. Postmortem investigations including radiology and biochemistry were performed. Based on the results of all investigations, deaths were attributed to natural causes. Third-party involvement could be excluded in both situations. In one case, biochemical analysis results revealed potentially contributing causes of death. The reported cases emphasize the importance of correlating findings from different postmortem investigations to identify causes of death, precipitating conditions and predisposing disorders, thus allowing the conclusion of natural death to be reached and third-party involvement to be excluded.

KEYWORDS: forensic sciences, autopsy, 3-beta-hydroxybutyrate, vitreous humor, pericardial fluid, ketoacidosis, postmortem biochemistry

The discovery of two bodies at the same death scene is a relatively infrequent finding in forensic routine and represents a difficult challenge for pathologists. From an investigative point of view, the hypotheses of double homicide, double suicide, homicide followed by suicide, and suicide after having found a dead person (from suicide, natural causes, or even homicide) are regarded as the most probable, although not conclusive, in elucidating the circumstances of death. Indeed, homicide-suicide is not an uncommon situation when the case involves spouses or those living together as a couple.

Beyond these hypotheses, other explanations may be invoked to clarify such findings, including simultaneous deaths with residential carbon monoxide toxicity, sudden death from natural causes after having found a (close) person dead (from homicide, suicide, or natural death), and even death from natural causes after having committed a homicide (1–3).

The death of a person as a reaction to the death of another is known as Philemon and Baucis death (4). This expression derives from the Greek myth reported by Ovid, according to which the old couple of Philemon and Baucis entertained Zeus and Hermes when, traveling through Phrygia in the form of humans, they were denied admittance by the other inhabitants. As a reward for their hospitality, Philemon and Baucis were spared when a flood swept the countryside and their cottage was turned into a temple. Years later, they were granted their wish to die at the same time.

It may be admitted that a person can die from natural causes after having found another person dead or, in general, following the death of another person, especially someone close. Episodes of acute emotional stress can have significant adverse effects on the heart through cerebral activity and produce left ventricular dysfunctions, episodes of myocardial ischemia, cardiac rhythm disturbances. Although these abnormalities are often only transient, their consequences can be gravely damaging and sometimes fatal, especially in those with underlying cardiac diseases (3).

Ciesiolka et al. (4) reported two cases of Philemon and Baucis deaths concerning two married couples found dead in their apartments. However, apart from this report and some other isolated cases presented during medicolegal meetings, the phenomenon is largely unknown. Furthermore, investigations performed on the death scenes in most presumed Philemon and Baucis deaths are often incomplete due to the advanced putrefactive changes of the bodies. Forensic investigations in such cases are therefore frequently limited, and results can be difficult to interpret. Considering the above along with unclearly established causes of death, a conclusion of double natural death may be difficult to draw.

In this article, we describe two cases of Philemon and Baucis deaths, the first concerning a married couple found dead at home and the second concerning a father and son found dead in the apartment where they lived.

Case Reports

Case 1

The bodies of a married couple (a 61-year-old man and a 63-year-old woman) were found in different rooms of their apartment. Upon arrival, police found the door of the apartment

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FIG. 1—The corpse of the man was discovered in the bathroom. Copyright 2011: Crime Scene Unit, Neuchâtel Police.



FIG. 2—The corpse of the woman was found on the floor in the bedroom. Copyright 2011: Crime Scene Unit, Neuchâtel Police.

locked from the inside with the key still in the lock. The corpse of the man was discovered in the bathroom, kneeling over the bathtub, legs leaning against the outside tub tile, upper body in the tub itself. Room temperature was 24°C (75.2°F). The man was wearing the bottoms of a tracksuit and underpants, torso nude (Fig. 1). The corpse of the woman was found fully extended in a supine position, leaning slightly on her left side. She appeared in a narrow space between two beds on the floor in the bedroom, right arm crossed at elbow level across the chest, the other extended alongside the body. Room temperature was 23°C (73.4°F). The woman was fully clothed wearing a T-shirt, bra, shorts, and underpants (Fig. 2). The bodies were not covered and both showed decomposition changes characterized by green discoloration of the skin, marbling of the chest, upper and lower extremities, skin slippage, and purging of a dark brown fluid from the nose and mouth. No tools or weapons were

found in the immediate vicinity of either corpse or in the other rooms, thereby excluding evidence of suicide or homicide. No suicide note was discovered. No electrical appliances were switched on. The macroscopic external examination of the bodies at the death scene revealed no injuries.

The entire apartment was in an untidy state. During the course of the inspection, several empty bottles of alcohol were found in the garbage containers as well as numerous empty packs of cigarettes. The windows in the apartment were closed, and the blinds were half-drawn.

Inquiries performed by the police in the neighborhood allowed some significant information to be collected. The couple had been seen for the last time by the neighbors 5 days before the discovery of the bodies, whereas the mail and the newspapers had not been collected for the last 10 days and were still in the mailbox. According to medical records obtained from local health services and the general practitioners, the woman suffered from chronic alcohol abuse and had suffered from a follicular lymphoma treated with radiotherapy and chemotherapy 19 years ago. Additionally, she had suffered from an infiltrating bladder carcinoma 5 years prior. The prescribed medical treatment consisted of mirtazapine and oxazepam, although the patient was described as noncompliant. The man suffered from chronic obstructive pulmonary disease, type 2 noninsulin-requiring diabetes and depression. His present medical treatment was quetiapine, valproic acid, trimipramine, and glimepiride.

Radiology, External Examinations, and Autopsies

Radiological investigations (unenhanced whole-body CT scans) performed prior to autopsy revealed only the presence of putrefaction-generated gases in most organs and vessels. External examinations were unremarkable except for putrefactive discolorations and other decomposition changes and did not show evidence of external traumas. Rigor mortis was dissipating at the major and minor joints. The distribution of postmortem lividity matched the position of the bodies and could not be eliminated by finger pressure. The man was 169 cm tall and weighed 59 kg. The woman was 159 cm tall and weighed 48 kg. Internal organs exhibited moderate to advanced decomposition changes. The man's heart weighted 340 g and the woman's heart 320 g. Neither hypertrophy nor cardiac cavity dilatation was observed. The aorta and coronary arteries exhibited mild to severe atheromatous disease in both cases. Lungs were not edematous, and no nodular lesions of the liver were found. The kidneys did not reveal any significant, macroscopic changes except for some subcapsular surface scars. There were only small amounts of yellowish-brownish adherent gastric content in the stomach and small intestine in both cases. No other abnormalities were detected elsewhere in the bodies. The main autopsy findings in the man were pulmonary emphysema and diffuse atherosclerosis. In the woman, the main macroscopic findings consisted of diffuse, severe atherosclerosis with an intramural, abdominal aortic thrombus, calcification of the aortic valve, hysterectomy, and cystectomy with urinary diversion due to bladder carcinoma.

Histology, Neuropathology, Toxicology, and Biochemistry

Histological examinations revealed areas of fatty degeneration as well as small fibrotic areas of the myocardium in the woman. Hyalinized glomeruli in the kidneys and decomposition changes in most organs were noted in both cases. Histology of the abdominal aorta in the woman confirmed the presence of an

intramural, nonocclusive thrombus characterized by alternating layers of platelets mixed with fibrin, erythrocytes, and neutrophils. Neuropathology was unremarkable in the man, although it revealed the presence of a grade I mixed meningioma of the olfactory groove in the woman.

Small amounts of cardiac blood, bile, cerebrospinal, and pericardial fluids as well as gastric content, hair, and samples of certain tissues (liver, kidney, and skeletal muscle) were recovered for toxicological analyses. These analyses included ethanol, CO, and cyanide determination as well as screening for common drugs and illegal substances by gas chromatography–mass spectrometry (GC-MS), high-performance liquid chromatography with diode-array detection (HPLC-DAD), and headspace-gas chromatography–flame ionization detection (HS-GC-FID).

In the man, toxicological analyses revealed the presence of ethanol (1.60 g/L) and traces of other volatile organic compounds in skeletal muscle. Quetiapine and one of its metabolites as well as one metabolite of trimipramine, consistent with prescription, were found in bile at concentrations that suggested therapeutic ranges. Ethylglucuronide concentration was determined in a hair sample and did not suggest chronic alcohol consumption in the months prior to death.

In the woman, toxicological analyses showed the presence of traces of ethanol, acetone, and other volatile organic compounds in the skeletal muscle, whereas no traces of drugs were found in blood. Ethylglucuronide concentration was determined in a hair sample and suggested chronic alcohol consumption in the 3 or 4 months prior to death.

Vitreous humor was unavailable, and postmortem biochemistry investigations were performed in pericardial fluid (3- β -hydroxybutyrate, procalcitonin, and C-reactive protein), cerebrospinal fluid (glucose and 3- β -hydroxybutyrate), and liver homogenates (3- β -hydroxybutyrate) obtained from liver samples.

Procalcitonin, C-reactive protein, glucose, and 3- β -hydroxybutyrate concentrations revealed normal levels in all tested samples.

Based on the results of all postmortem investigations and within the limits of the decomposition changes, we cautiously concluded that both deaths could be attributed to natural causes. As the bodies showed comparable signs of decomposition upon external and internal examination, the order in which the couple died could not be distinctly determined.

Case 2

The bodies of a father and a son (father 89 years old, son 67 years old) were both found in the living room of the apartment where they lived together (Fig. 3). The authorities were alerted by another son who had tried to contact his father several times unsuccessfully some days prior. Upon arrival by the police, the door of the apartment was found locked (three different locks) from the inside. In addition, a metal protection bar blocked the door from the inside. Room temperature was 25°C (77°F). The father's body was discovered on the floor in a left, dorsolateral position, wedged between two sofas, next to the radiator and the window of the room, the right, parietal region of the head lying on an exercise bike. Both legs were tucked up and turned on the left side. He was wearing a T-shirt, shirt, coat (only present on the left upper limb) and paper underpants for adults, which were soiled with fecal material. The corpse of the son was found on the floor in a supine position in front of one of the sofas, the right lower limb tucked up, head lying on the right buttock of the father, shoulders and back lying on the father's feet. He was wearing a polo shirt, a T-shirt, pyjama



FIG. 3—The corpses of the father and the son were both found in the living room of the apartment where they lived together. Copyright 2012: Crime Scene Unit, Geneva Police.

bottoms, underpants and socks. No explanation could be found to explain the position of the bodies. They were not covered and both showed decomposition changes characterized by green discoloration of thoracic and abdominal skin as well as green-gray discoloration of the skin of the face and neck. The skin over the fingers and tiptoes also showed evidence of beginning mummification. The son's mouth was open, and the tongue was covered by a dry, black, friable material which also soiled the palate. Upon manipulation of the body, a dark red fluid spilled from the mouth and nose. The father's mouth was also open, and the palate was covered by a similar dry, black, friable material. External examination of the bodies at the death scene did not reveal injuries. Both bodies were lying on different objects situated on the floor. The entire apartment was in a state of disrepair and squalor.

No tools or weapons were identified in the immediate vicinity of the bodies, nor in the other rooms of the apartment. No suicide note was discovered. No electrical appliances were switched on. During the course of the police inspection, several empty bottles of alcohol were found in the apartment. The windows were closed and the blinds down. Antihypertensive drug tablets (valsartan and hydrochlorothiazide) and benzodiazepine drugs (bromazepam) were noted in the kitchen, bathroom, and living rooms. According to medical records, the father suffered from polymyalgia rheumatica and hypertension, the treatment for which consisted of valsartan and hydrochlorothiazide. No medical information was available for the son.

Radiology, External Examinations, and Autopsies

Radiological investigations performed prior to autopsy did not show any sign of radio-opaque suspected density. External examinations showed decomposition changes in both cases, as well as a jaundice of the skin and sclera of the son. The examinations did not otherwise show evidence of external trauma. Rigor mortis was dissipating at the major and minor joints. The distribution of postmortem lividity matched the position of the bodies and could not be eliminated by finger pressure.

The father was 183 cm tall and weighed 70 kg. The son was cachectic (179 cm tall, 50 kg weight). Internal organs exhibited moderate postmortem autolysis in both cases. The father's heart weighed 510 g and showed moderate dilatation and hypertrophy. His aorta and coronary arteries exhibited mild to severe

atheromatous disease with partial stenosis (50%) of the right coronary artery as well as partial stenosis (30%) of the left common carotid artery. The son's heart weighed 500 g and showed dilatation of the right cavities as well as blood clots in the right atrial appendage. The aorta and coronary arteries exhibited mild to severe atheromatous disease with partial stenosis of the right coronary artery. The father's lungs appeared normal, whereas the presence of a middle lobe infarction was identified in the son's right lung, referred to a recent pulmonary embolism in the right middle lobe artery. Deep vein thromboses in both lower legs were also observed in the son, with various degrees of healing. No hepatic nodular lesions were found. The kidneys did not present significant, macroscopic changes except for some simple cysts. Gastric content was represented by a small amount of a black liquid in both cases and did not exhibit any pill fragments visible to the naked eye. No other abnormalities were detected elsewhere in the bodies. The main autopsy findings in the father were cardiac hypertrophy and dilatation as well as atheromatous disease with partial stenosis of the right coronary artery. In the son, the main macroscopic findings consisted of a pulmonary embolism in the right middle lobe artery, infarction of the middle lobe of the right lung, right atrium dilatation, blood clots in the right atrial appendage, and deep vein thromboses of different ages in both lower legs.

Histology, Neuropathology, Toxicology, and Biochemistry

Histological examinations revealed the presence of hyalinized glomeruli in the kidneys and decompositional changes in most organs in both cases. In the father, histology also showed the presence of small bronchopneumonia foci in the inferior lobe of the right lung as well as pulmonary emphysema. In the son, histology confirmed the presence of thrombi in the deep veins of both lower legs with different degrees of healing, as well as a pulmonary embolism, infarction of the right middle pulmonary lobe, and thrombi of different ages in the right atrial appendage. Neuropathology was unremarkable in both cases, within the limits of decompositional changes.

Small amounts of peripheral blood from the femoral vein, cardiac blood, bile, vitreous humor, urine, cerebrospinal, and pericardial fluids as well as gastric content, hair, and samples of certain tissues (liver, kidney, and skeletal muscle) were recovered for toxicological analyses. These analyses included ethanol, CO, and cyanide determination as well as screening for common drugs and illegal substances by gas chromatography–mass spectrometry (GC-MS), high-performance liquid chromatography with diode-array detection (HPLC-DAD), and headspace-gas chromatography–flame ionization detection (HS-GC-FID).

Toxicological analyses were negative for all tested substances in both cases. Ethylglucuronide concentration was determined in hair samples and suggested chronic alcohol consumption in the 3 or 4 months prior to death in both cases.

Further toxicological analyses were performed in numerous liquid and solid matrices collected at the death scene, including the dry, black, friable material found in the mouths of both subjects. Results of all these analyses were negative, and the nature of the material could not be identified.

Due to postmortem serum unavailability and the limited amounts of blood collected on autopsy that were used for toxicological analyses, biochemical investigations were performed in vitreous humor (glucose, 3- β -hydroxybutyrate, procalcitonin, and C-reactive protein), pericardial (glucose, 3- β -hydroxybutyrate, procalcitonin, and C-reactive protein), and cerebrospinal

(glucose) fluids as well as liver homogenates (3- β -hydroxybutyrate) obtained from liver samples.

Procalcitonin was at normal levels in both cases and in both tested fluids (vitreous and pericardial fluid). C-reactive protein concentrations were slightly increased in pericardial fluid in both cases (52 mg/L in the father and 54 mg/L in the son). Vitreous, pericardial, and cerebrospinal fluid glucose levels were normal (lower than 2 mM) in both cases. Vitreous and pericardial fluid 3- β -hydroxybutyrate concentrations were normal in the son and increased in the father (1900 μ M in vitreous and 2000 μ M in pericardial fluid).

Based on the results of all investigations, the death of the son was attributed to natural causes, mainly represented by ischemic heart disease as well as pulmonary embolism and infarction. In the father, ketoacidosis was thought to have caused or contributed to death, in association with pre-existing ischemic heart disease. However, the exact origin of ketoacidosis could not be established.

As the bodies showed comparable signs of decomposition on external and internal examination, the order in which they died could not be distinctly determined.

Discussion

Unnatural deaths involving more than one person at the same time are most often encountered in motor vehicle crashes, fire fatalities, or industrial accidents. These occur more rarely in fatalities from explosive devices or aircraft crashes. Very occasionally, two or more dead bodies from unnatural causes of death beyond those above are discovered at the same time. Once double or multiple homicides have been excluded, the major difficulty encountered by officers in charge of investigations in these cases includes determining whether the deaths are the result of a double suicide (for instance collective suicide or a suicide pact) or a murder-suicide (5).

Murder-suicide, homicide-suicide, and dyadic death all refer to incidents where a homicide is committed followed by the suicide of the perpetrator almost immediately or soon after the homicide (6). The killing of a spouse (commonly associated with discord in the relationship) and children killed by their parents are the most common forms of homicide-suicide (1,6–8). More infrequent forms are familicide-suicide, extrafamilial homicide-suicide, and homicide involving parents and siblings (6,9,10).

Another possible situation is represented by suicide after having found a dead person, from suicide or natural causes (and theoretically from a homicide as well). In such cases, determining the order in which the victims died as well as the causes and manners of death is of utmost importance in understanding the exact sequence of events, circumstances of deaths, and exclusion of third-party involvement for inheritance purposes.

We have, in our experience, only sporadically come across situations in which investigations on the death scene and post-mortem examinations allowed unclear contexts to be precisely elucidated, such as suicides after having found a dead person, typically someone close, from suicide or natural causes. We recently observed a case of two friends (a man and woman) who were discovered in one of the two's apartment. The body of the man was found on the floor in prone position and showed advanced decompositional changes. A black plastic bag was over his head and tied around the neck with a thin rope. The rope was strongly tied and had a posterior knot as well as a free end with a frayed extremity. The body of the woman was discovered seated on a chair with no evidence of external trauma.

mas or injuries. Decompositional changes were absent. Rigor was present in the major and minor joints, and the distribution of lividity matched the positions of the bodies and could be eliminated by finger pressure. In the days following the accident, a suicide note was found in which the woman stated that she had discovered the body of her friend lying on the floor in the apartment some days before. She explained that a suicide note was present in the room and that she assumed he had hung himself from the bathroom door because an extremity of the rope was still tied at the handle of the door and the free end hung from its upper end. The body of the man was on the floor, probably as a result of rope rupture, with a plastic bag over his head. The woman decided to hide both note and rope and watch over the man's body, speaking to him "until he was back awake and could tell her good-bye for the last time". Some days afterward, when she realized that he would not longer have spoken to her, she decided to kill herself by taking antidepressant drugs.

Due to the unclear circumstances of body discovery, primary investigations could not exclude third-party involvement. The hypothesis of homicide-suicide was also formulated. The explanation note found successively allowed the circumstances of both deaths to be clearly elucidated. Within the limits of the decompositional changes, radiology, autopsies, and toxicological analyses confirmed the cause of death in both cases (hanging for the man and drug intoxication for the woman) and allowed other trauma and injuries to be excluded in both situations, as well as third-party involvement.

Albrecht et al. (2) described the unique case of a man who committed a homicide and died immediately after from cardiac failure. In this reports, the authors highlighted the importance of the pathophysiological relationships between physical strain, acute emotional stress, and sudden death.

Concomitant deaths from natural causes have been described in infants due to genetically-based cardiac dysfunctions (11–14).

In adults, sudden death from natural causes in a person who had found another person, especially someone close, dead from suicide, natural death, or homicide, emphasizes the role of acute emotional stress as a trigger factor in sudden cardiac death.

Philemon and Baucis deaths, as in the cases herein reported, would thereby represent an example of situations in which the death of a person represents a strong, acute emotional stress for the person who finds the body. Such stress would be able to determine cardiac dysfunctions and consequently lead to death, especially in those with pre-existing, underlying cardiac disease.

Acute and chronic psychic stresses are known to cause neurovegetative alterations inducing transitory or persisting bodily dysfunctions. The neurovegetative changes deriving from such stress may include hemodynamic responses, autonomic alterations, and neuroendocrine activation as well as inflammatory and prothrombotic responses, which have a potentially negative influence on the cardiovascular system (15). The increased frequency of sudden death after emotionally devastating disaster, such as earthquakes, wars, or terrorist bombing attacks, has long suggested that emotional distress can play a role in acute coronary syndromes and arrhythmias, primarily, but not exclusively, in individuals with pre-existing heart disease, thus suggesting the role of cerebral activity in determining, for instance, arrhythmic episodes (16–22).

Numerous authors (22–26) have reported cases of so-called "homicide by heart attack", in which the sudden death of the person with underlying cardiac disease was thought to be caused

by an arrhythmic episode precipitated by physical and/or emotional stress induced by the criminal activity of another person.

Cebelin and Hirsch (27) reviewed homicidal assaults that occurred in Cuyahoga County (OH) over 30 years, focusing on autopsy and investigative findings relating to victims who died as a direct result of physical assaults without sustaining internal injuries. The authors interpreted these data as being strongly supportive of the role of catecholamine mediation in determining myocardial changes, which were comparable to those described in stressed animals used in experiments. The authors concluded that stress was a factor potentially leading to death through its effects on the heart.

According to Ziegelstein (3), the lateralization of cerebral activity during emotional stress could stimulate the heart asymmetrically and produce areas of inhomogeneous repolarization, thereby creating electrical instability and facilitating the development of cardiac arrhythmias.

The determination of cause and manner of death in presumed "Philemon and Baucis deaths" is challenging due to the unclear circumstances in which the bodies may be found, decompositional changes often associated with the bodies and the possibility of third-party involvement. These deaths therefore require turning to radiological investigations, autopsies, toxicological, and biochemical analyses as well as necessitating the correlation of autopsy findings, scene investigations, and, when available, the victims' medical and social histories and laboratory results.

Similar to the report by Ciesiolka et al. (4), in the cases herein presented, forensic investigations were particularly problematic due to postmortem alteration and the consequent, relative unavailability of biological samples during autopsy for toxicology and biochemical analyses.

Despite postmortem alteration and the small amounts of biological fluids, biochemical investigations in case number 2 revealed increased 3- β -hydroxybutyrate values in vitreous and pericardial fluid in one of the two cases. 3- β -hydroxybutyrate concentrations have been shown not to increase with postmortem changes; hence, postmortem concentrations in blood and other biological fluids, such as vitreous and pericardial fluid, can be considered reliable markers of 3- β -hydroxybutyrate concentrations at the time of death, even in decomposed bodies (28,29). Kadiš et al. (29) also observed that 3- β -hydroxybutyrate does not increase after death but, at most, may decrease due to the spontaneous molecule degradation.

In the father and son case herein presented, ketoacidosis was thought to have caused or contributed to death of the father, in association with pre-existing ischemic heart disease. However, due to decompositional changes, the exact origin of ketoacidosis could not be established.

Postmortem investigations allowed traumatic causes of death to be excluded and natural causes of death to be assumed in both situations. However, the order in which the people died (the one in the couple who died first from natural causes and the one who died from the consequences of the acute emotional stress following the first person's death) could not be precisely elucidated.

Notwithstanding these uncertainties, these cases highlight the importance of correlating the results of several forensic investigations as well as the usefulness of postmortem biochemical analyses when two bodies with decompositional changes are discovered in unclear circumstances. As shown in case number 2, postmortem biochemical investigations can occasionally be performed on biological fluids other than blood despite decompositional changes and reveal useful results to formulate appropriate hypothesis concerning the contributing causes of death.

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