

THE PHON EFFECT IN THE ABANDONED MUMMIFIED

Maricla Marrone, University of Bari
Benedetta Pia De Luca, University of Bari
Stefania Lonerio, University of Bari
Francesca Tarantino, University of Bari
Davide Ferorelli, University of Bari
Pierluigi Caricato, University of Bari
Luigi Buongiorno, University of Bari
Francesco Vinci, University of Bari
Serena Corradi, University of Bari
Alessandra Stellacci, University of Bari

ABSTRACT

Social isolation, confinement in the domestic context up to abandonment, phenomena as serious as they are frequent in modern society, has been emphasized by the advent of the Sars-Covid19 pandemic. The authors report the case of a 39-year-old woman found lifeless and in a partial state of mummification ("hair dryer effect"), lying on her back on the bed and covered, in part, by a quilt. At the foot of the bed a hairdryer was found connected to the electrical outlet. The environmental conditions favored the initiation of special transformative putrefactive processes, such as that of mummification. Investigating a mummified body found, to determine the cause and manner of death, can be difficult for the forensic pathologist. For the definition of the time of death we generally use the degree of evolution of postmortal transformative phenomena which, as we move away from the moment of death, offer less and less possibilities to delimit this period within narrow time limits, especially when these phenomena are strongly affected by the environmental factors in the context of which the corpse has stayed, as occurred in the present case. A careful analysis of the places where the death occurred and the circumstantial data possibly available to the coroner can provide useful data for the proper assessment of the case. The reporting of this event must be considered an important isolated case study for the analysis of the mummification process, as well as a warning light on an increasingly widespread social problem.

Keywords: Mummification, Time of Death, Autopsy, Neglect

INTRODUCTION

Social isolation and confinement in the domestic context are problems that characterize certain age groups and/or conditions of hardship. In the pandemic era of Sars-Covid19, confinement in one's home, social isolation and the drastic reduction in human relationships favored the spread of this problem, also involving "active" age groups (Monahan, 2020). However, it remains relevant, as well as serious, that human "abandonment" is such that it must be stemmed only by bureaucratic needs. Dying in a context of abandonment favors the late finding of the body and this in turn allows the establishment of destructive/transformational phenomena typical of putrefaction that make the investigation more complex for the forensic pathologist of the time and the cause of death (David, 2005; Collins, 2007; Megyesi, 2005). In such cases, the circumstantial data, such as for example dates found on receipts or receipts,

last accesses on telematic portals, last use of the mobile phone, as well as the inspection of the places, assume considerable importance, especially if consistent with what will be detected, then, to the cadaveric inspection. The latter will show the inevitable result of the time elapsed since death and of the interaction, during that time, between the body and the environment. The general process and pattern of soft tissue decomposition are well documented and understood (Adlam, 2007; Clark, 1997). The initial driving force is the result of cellular autolysis, a process that begins soon after death and in which intracellular components are dumped into surrounding tissues facilitating the proliferation of bacterial populations, physiologically present within the human organism (Mayer, 2012; Finaughty, 2009). These bacteria initiate the digestion of internal tissues, a by-product of which is gas; the accumulation of internal gas appears as swelling and purging of fluids and gases from the orifices, elements that stimulate the intervention of the environmental fauna. However, specific environmental conditions can alter this pattern and prematurely stop the decay process. An example of this is natural mummification, a process characterized by drying, brittleness and shrinking of the skin and body tissues (Evans, 1963). Mummification is, therefore, a transformative process deriving from the rapid leakage of liquids, generally favored by a dry and windy external environment (Haglund, 1997; Umani, 2002) which leads to the obstruction of the normal progression of putrefaction and produces depletion of the water tissue (Ronchi, 1989). Considering the endogenous factors influencing post-mortem changes, mummification occurs more easily in lower-weight bodies, older people, and fetuses. Diffuse bleeding and dehydration also predispose to natural mummification (Giusti, 1998). The mummified corpse has a brownish color and a parchment-like skin that adheres to the bones. In addition, there is an overall decrease in volume and weight, even when the internal organs appear thick and light. In the forensic literature (Gerin, 1997; Kashimura, 1984) mummification is reported as a process that generally takes between 6 and 12 months to occur. Cases of early mummification have been reported (Saukko, 2004), but they have occurred in countries with more extreme weather conditions than Italy, such as Egypt, Chile or Peru (Marracino, 1968). They also develop in a restricted environment and in particular microclimatic conditions (Papageorgopoulou, 2015). In the case reported by the Authors, the mummification was able to take place in a short time (thanks to a slowdown of the putrefactive processes and a speeding up of the dehydration process) precisely due to the simultaneous presence of a series of factors, including the hairdryer on and in an environment closed for about 20 days.

CASE REPORT

The body of a 39-year-old woman was found lifeless and partially mummified ("hair dryer effect"), lying supine on the bed, covered with a quilt that left only the head, neck and upper 1/3 of the chest uncovered and the upper limbs (Figure 1).



FIGURE 1
THE CHEST UNCOVERED AND THE UPPER LIMBS

Lifting the quilt, the corpse was found lying on the mattress with the lower limbs extended and slightly apart; next to the body and below the quilt there were various objects piled up in a disorderly manner (wrapped candies, clothing, a pen and a sheet) (Figure 2).



FIGURE 2
DISORDERLY MANNER

The skin of the body appeared of increased consistency with evident reduced elasticity on palpation and of a yellowish brown color, almost uniform. It was also possible to glimpse the presence of the putrefactive green net, more evident in the hemithorax and the left hemithorax (anterior surface) and the root of the lower limbs. At the foot of the bed, on the floor of the room, there was a plastic basin, a package of antiemetic and prokinetic drug (domperidone); moreover, in correspondence with the headboard of the bed, on the “foot” side, there was placed a hairdryer connected *via* an electric socket to a power generator (multi-socket).



FIGURE 3
HAIRDRYER CONNECTED VIA AN ELECTRIC SOCKET TO A POWER GENERATOR

All the windows of the apartment were regularly closed and without signs of forced entry and the whole house was characterized by a state of neglect (dirt and dust on the floors and furniture of all the rooms) and disorder (together with the Christmas decorations there it was stuff of various kinds stacked, inside and outside the furniture). During the inspection of the places, more precisely inside one of the bathroom fixtures (toilet), the presence of toilet paper soaked in yellowish, amorphous material was found, later identified as vomit. The external examination of the corpse allowed, despite the special putrefactive transformations already underway, to exclude the presence of significant recent signs of traumatic injury.

The historical-circumstantial data collected during the inspection also addressed the definition of the cause of death in this sense, not offering useful elements for the violent hypothesis and rather supporting the pathological-natural one. The subsequent cadaveric section showed, as the only macroscopic relief worthy of note, the presence of an aneurysmal dilatation with dissection of the right vertebral artery wall at the level of the upper end of the brain stem. The histological investigations performed on the tissue fragments taken during the autopsy allowed to microscopically confirm the macroscopically formulated diagnostic hypothesis, highlighting a focal intimal thickening of the wall in contiguity with an area of slipping and discontinuity of the internal elastic lamina at the level of the right vertebral artery. To verify the possible influence of toxic or narcotic substances on the determinism of the victim's death, chemical-toxicological investigations were carried out on the biological material collected during the autopsy; in particular, immunoenzymatic screening for the search for drugs of abuse (Qualitative Analysis) and screening and possible confirmation analysis by mass gas chromatography (GC-MS) for the search for basic, acidic and neutral toxicants. The subsequent negativity found at the outcome of the chemical- toxicological investigations made it possible to confirm the diagnostic hypothesis formulated in the autopsy, *i.e.*, a death due to cerebral haemorrhage (stroke with toxic neuronal damage) from rupture of the right vertebral artery. In support of this, it should be remembered that the laceration of the intracranial tract of the vertebral artery causes cerebral hemorrhage, resulting in ischemia of the lateral portion of the bulb and cerebellum. The main symptoms and signs of the aforementioned ischemia are represented by gait disturbances, ataxia, balance disorders, nausea and vomiting. Extensive cerebellar infarcts can cause hypertension of the posterior fossa and coma from compression of the brainstem, a potentially life-threatening complication. At least one of the aforementioned symptoms of intracranial hypertension due to rupture of an intracranial vessel, namely cerebral vomiting, was likely manifested in the present case. Infact, during the inspection, inside the victim's home, at the foot of the bed, a plastic basin and a package of antiemetic and prokinetic drugs (domperidone) were found; the latter are all clearly indicative of a gastrointestinal discomfort (nausea and vomiting) which in turn is likely attributable, also in the light of what emerged during the cadaveric examination, to a central origin. Well, it is evident that all the available elements (historical and circumstantial data, objective elements found during the inspection, findings that emerged from the cadaveric, histological and toxicological examination) clearly depicted a consequent death due to natural pathological causes, linked to toxic neuronal damage in turn resulting from cerebral haemorrhage (stroke) from intracranial rupture of the right vertebral artery. Always all the elements available to the authors also gave evidence, however, for a sad story of abandonment: the woman, only 39 years old, despite having two parents and a sister living, was found dead, during the Christmas period, after about 20 days of his death, only at the request of the condominium administrator, in order to collect the monthly fee.

DISCUSSION

Mummification is a special transformative phenomenon that occurs when the corpse undergoes a rapid evaporation of the liquids of the tissues for storage in very ventilated, hot and low humidity environments. Infact, these factors lead to an arrest of putrefactive processes as they prevent bacteria from having an adequate metabolism. Mummified fabrics, that is, without water, are preserved almost unchanged over an almost indefinite time (Rodriguez, 1983). It is known, however, that during the mummification process, despite the rapid superficial dehydration of the skin, the underlying tissues often remain moist and continue to deteriorate (Leccia, 2018). Even in the case analyzed by the authors, the internal organs were partially putrefied. However, the rapid dehydration of the soft tissues protected the internal organs from colonization by insects, ensuring good preservation of the corpse. The skin appears dehydrated and the whole corpse appears desiccated; the somatic characters

are however still recognizable and it is possible to identify any outcomes of traumatic lesions of various kinds on the skin. In very favourable environments, for example the desert areas, but also in the southern regions of Italy, mummification, which usually takes up to a year, can be completed very quickly, even within a single week, thus posing considerable difficulties for the definition of the time of death. Very often, only an approximation of the time of death can be reached when a body undergoes transformative processes, such as mummification. Leccia, et al., report on 20 mummies found between 2002 and 2016. Extensive mummification (defined in this paper as “at least 50% of the body's skin mummification”) occurred in just three weeks and the post mortem interval was estimated from indirect indications; in most cases, however, the cause of death could not be identified. To express an opinion on the thanatocronology of a case, it is necessary to carry out an analysis considering both the data of the scientific literature and the specific factors of the case in question. To quote Piombino-Mascoli, Gill-Frerking and Beckett : “Natural, or spontaneous, preservation is of tremendous scientific importance”. Knowledge of the various processes that drive this phenomenon are crucial for understanding the taphonomy of the remains recovered not only from forensic, but also from historical and archaeological contexts. In some cases, radiological instrumental examinations, such as CT, are an excellent non-invasive way to analyze mummified individuals (Davey, 2013). For example, Davey et al. used radiology to determine the sex of a mummy who had conflicting records based on two different translations of a name written in a section of papyrus inserted into the mummy's casings and also to determine the type of mummification used to preserve the body. Micozzi described the decomposition process as a "competition between decomposition and desiccation". He highlighted the importance of the interaction of the variables of an ecosystem in determining the onset of the putrefactive process rather than the drying one. It is more likely, in fact, that the remains are able to be preserved better when there are a series of variables that favor the drying of the body and that hinder putrefaction. It is known that warm and dry environments favor conservation, although the drying of fabrics can take place at any temperature; the prerequisite is the lack of ambient humidity (Campobasso, 2009; Lynnerup, 2007; Galloway, 1989). Numerous regions of the world characterize these conditions, but temperate climates are not generally mentioned among them. Cases of early mummification are few and are generally associated with extreme climatic conditions. For example, Kashimura et al. report a mummified body within 25 days inside a prefabricated structure in Japan during a heat wave; Galloway et al. of a mummification that developed in just 11 days in the arid climate of Arizona; similar times are reported by Rhine and Dawson in the arid climate of New Mexico. Marella et al. on the other hand, report a case of mummification which occurred within 4 weeks of the death of the individual in an Italian region with a temperate climate. The rarity of the occurrence of early mummification refers to the specificity of the conditions that facilitate it (eg conditions of prolonged heat, dry and/or windy - drought type). Megyesi, et al., even modified the TBS (Total Body Score) scoring criteria for determining the time of death in individuals found mummified. In 2013, the Section of Forensic Medicine of Rome Tor Vergata, reported the case of a subject who underwent mummification in four weeks, due to particularly favorable microclimatic conditions (Mummies, 2007). In particular, the victim was hit by a train, which it caused extensive lacerations throughout the body, as well as amputations of the limbs, causing significant bleeding. In addition, she was exposed to higher average temperatures than those generally found in Central Italy. Diffuse bleeding is a known factor in favor of mummification as it hinders the normal putrefactive processes that occur after death. Furthermore, these injuries have also speeded up the dehydration process, by virtue of a greater contact surface between the body and the external environment. Kashimura et al. and Campobasso et al. demonstrate how a hot and dry microclimate - such as that which can occur in a closed room or house - can cause the onset of rapid spontaneous natural mummification, even in a temperate climate. The conditions that induce mummification can strongly delay and even stop the decomposition mediated by bacteria and insects, which,

together with the drying of the soft tissues mediated by the environment, contributes to the early spontaneous natural mummification. Indeed, dried tissues inhibit the putrefactive activity of bacteria and fungi that require water to function and proliferate (Kelly, 2009). If the action of the micro fauna fails, one of the main external drivers of body decomposition is lost. In summary, even in non-extreme weather conditions, "early" mummification can occur if a series of parameters that hinder putrefaction are added together and instead favour the onset of mummification; unfortunately, abandonment is among these parameters in the case in question.

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