

ON ROSALIA LOMBARDO'S CAUSES OF DEATH AND THE METHOD USED BY ALFREDO SALAFIA TO EMBALM HER

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Abstract.

This paper describes research on Rosalia Lombardo's causes of death and on the method and chemicals used to embalm her. The mummy rests in the Cappuccini Catacombs in Palermo, Sicily. Rosalia died at the age of two in 1920 and was embalmed by Alfredo Salafia using a secret technique and particular mixture of chemicals. Until recently, no laboratory analysis had been performed on this mummy, and as a consequence, many doubts remain about the chemicals used by Salafia, although a manuscript by the embalmer had been discovered. This paper considers the numerous questions that still remain open.

Rosalia's appearance through the years.

A study performed to find out if Rosalia had always presented the same appearance during the years since her death gave surprising results. After a persistent search through published descriptions and personal accounts, I am now almost certain that Rosalia in the past has been continually on view to the public even in recent times. Some books describe Rosalia as wearing a "light-colored, frilly dress" (Quigley, 2006)

or a "peach-coloured dress" (Corzani, 2003). However, a student of the University of Massachusetts (Amherst), Andrea M. Peers, visited Rosalia in 2000 and described her wearing a blue dress, exactly as in my childish memory: "But the body of Rosalia was not a skeleton at all. She looked like a wax figure in a museum. She lay in her case, eyes shut, as if sleeping. Her face was still rosy with color; her blue dress perfectly fit on her small body. Her blond locks of curly hair remained in place with a

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blue bow that matched her dress. Her glass coffin was showered with roses of different colors. She resembled a porcelain doll in her box, a collector's item never opened, never touched, never disturbed." (Peers, 2000). Amazingly, in one book (Urbain, 1978) I found a photograph taken in 1976, where Rosalia's coffin seems to be different, larger than the present one. And in an old postcard that somebody showed me, the coffin is yet again different, showing a fringed edging around the coffin under the top glass (Fig. 1).

It is now clear that we can no longer

say that Rosalia has remained sealed in the same coffin for 86 years, untouched since 1920 when Alfredo Salafia embalmed her, as the National Geographic Explorer claimed in its documentary dedicated to the embalmer (Bowman, 2009). This realization brought me to an important conclusion: even if we can say that Rosalia is remarkably well preserved, at some point her body started to decompose, or perhaps it required frequent restoration over the years. In any case, such changes can be logically related to the causes of her death.



Figure 1. An old postcard showing Rosalia in her coffin.

The causes of her death.

According to the oral tradition, Rosalia died from a common pandemic disease: influenza. This led some people to think that she was struck down by the Spanish flu that appeared in 1918, causing almost 50 million deaths throughout the world. Indeed, most of the victims of Spanish flu were healthy young adults, and this epidemic was concentrated mainly during 1918-19 (Taubenberger & Morens, 2006). Rosalia died on December 1920, five years before the next flu epidemic.

In 1925 an outbreak of diphtheria struck Nome, a town in Alaska. The episode is remembered for the famous 'serum run': 150 sled dogs relayed diphtheria antitoxin 674 miles across the U.S. territory of Alaska in a record-breaking five and a half days, saving the small city of Nome and the surrounding communities from an incipient epidemic. Diphtheria was a highly infectious disease that affected many children, and in 1920 it was widespread in Italy. According to a medical survey, at the beginning of the XX century, every year in Italy 20-30,000 cases of diphtheria were recorded among children, with a mortality rate of 1500 dead. It must have been common in Palermo, because Michele Gerbasi, a pioneer of pediatric medicine in that town, wrote an essay about statistical and clinical observations on diphtheria in childhood in Palermo during 1919-1925, with particular attention to the

medical treatments. Gerbasi noted that diphtheria was endemic in Palermo, mainly in newborns and children aged under two years. The disease was more recurrent in winter, especially in December, with 65 per cent morbidity reaching the maximum at age two, due to the bad sanitary conditions in Palermo; the morbidity in other countries was not so high (Gerbasi, 1925).

At the time when Rosalia died, there were already two methods of treating diphtheria. The older method was tracheotomy, but in 1890 the German physician Emil Von Behring developed an anti-toxin therapy. In his study based on 278 cases of diphtheria treated in the Pediatric Clinic at Palermo University in the years 1919-25, Gerbasi reports a mortality rate of 21.8 per cent, a rate higher than reported in other studies elsewhere in Italy. He asserted that the mortality rate was higher for children aged 1-2 years, and also reported minor recoveries for the years 1919-20. The cause of death could have been due to the serum itself, according to Gerbasi, since the amount of anti-toxin that it contained might not have been high enough to be effective (Gerbasi, 1925). Another factor was the timely administration of the anti-toxin. Since anti-toxin does not neutralize toxin that is already bound to tissues, delaying its administration is associated with an increase in mortality risk.

Unfortunately, in Rosalia's time, diagnostic criteria were vague. In Palermo,

it was only in 1933 that Giuseppe di Chiara established a very well equipped clinical laboratory. Maybe Rosalia died because her illness was not treated in due time, or perhaps she died because the serum administered contained not enough anti-toxin.

But the relevant issue for Rosalia's embalming is the changes that diphtheria causes in a human body. The disease is caused by a bacterium, *Corynebacterium diphtheriae*, which can survive in extreme conditions such as very hot temperatures (higher than 600° C). It is one of the so called 'sit-and-wait' pathogens (Walther & Ewald, 2004). The 'sit-and-wait' hypothesis predicts that virulence should be positively correlated with the pathogen's survival in the external environment because high durability reduces the dependence of transmission on host mobility. Walther and Ewald (2004) calculated that the most virulent pathogens are *variola* virus (able to survey 885 days without a host), *tuberculosis* bacterium (370 days) and, finally, *Corynebacterium diphtheriae* (244 days). Once in the body, the bacterium produces a toxin that inhibits cellular protein synthesis and is responsible for local tissue destruction and membrane formation. The toxin is responsible for major complication such as myocarditis, which may culminate in heart failure, and neuritis that can lead to respiratory failure and pneumonia.

Moreover, toxin absorption can lead to

necrosis of kidney tubules (Atkinson & al., 2007).

We learned from a letter addressed to the Editor of the *Virchow Archive* review that a recent assessment of Rosalia's body through conventional X-rays revealed remarkable preservation of the corpse with "minor deterioration" (Piombino-Mascali & al., 2009). Indeed, this "minor deterioration" is clarified later in the letter when the authors report more details from the radiography of her body in the captions to Fig. 1/c: they state "Conventional X-Ray of the child revealed a very well-preserved brain and liver...", then note that the low quality of the image is due to the presence of a lead lining in the coffin which severely affected the radiological investigation (Piombino-Mascali & al., 2009). In any case, another vital organ, the heart, should have been visible but is not mentioned—perhaps because this organ was fatally damaged to the point that not even Salafia's art could have preserved it? And what about the kidneys and the lungs? In another article (Piombino-Mascali & Johnson-Williams, 2009), two of the authors write "a recent X-ray examination helped to establish that the tissue covered by the cloth and the internal organs are beautifully preserved with the exception of the medial thighs, which seem to have degraded". To sum up, apart from the brain and the liver, no information is given about the other organs, and the deterioration of

‘the medial thighs’ is not elaborated. The former considerations make me wonder if the cause of Rosalia’s death was diphtheria, rather than pneumonia, which these researchers reported without giving any explanation of their diagnosis (Piombino-Mascali & al. 2009). Here follow some implications for the embalming process and the special fluids used by Alfredo Salafia to treat her body.

About the chemicals Salafia used to embalm Rosalia.

From the same letter quoted above, we learn that the authors rely upon an unpublished manuscript that they received from Salafia’s relatives, which contained the chemical formula that Salafia used to obtain such brilliant results. Yet I doubt that he used the same formula for all the corpses he treated, especially in the case of Rosalia. I have not had the privilege of reading the manuscript to verify that at least one paragraph is dedicated to the present case, but additional doubts were raised by my comparison with the other well preserved body in the catacombs treated by Salafia: the body of Giovanni Paterniti, embalmed by him in April 1911. If Alfredo Salafia used always the same formula, why is the body of Giovanni Paterniti so different in color from that of Rosalia, especially if, as the scientists declare, the body of Rosalia was treated only once and sealed in the same coffin for ninety

years? In Fig. 2 I propose a comparison also with another mummy in the crypt: that of Antonio Prestigiaco, a mummy preserved in 1844 by the method of an arsenic bath. This was a technique that the Cappuccini Monks used until the middle of the XIX Century for people who died from highly contagious diseases, to prevent spread of the pathogens. When Salafia was operating, arsenic was banned in France, following a law adopted by King Louis-Philippe in 1846. There was then a trend throughout Europe to ban all poisonous substances from use in embalming. Arsenic was not only poisonous to the embalmers, but it could have been used in the embalming practice to hide a crime. Yet in Italy the law was not so severe. In fact, we learn from F. Di Colo (1910) that the Sanitary Law ordered that permission to embalm a body had to be formally requested with a letter to the Mayor of the town. He gave the permission after 24 hours’ observation of the body, and on the basis of the death certificate verified that the person did not die from a crime (including the use of poisonous substances). If the person died from an infectious disease, the time of observation could be shortened. In any case, the embalmer should only state the method he was going to use and nothing else (with no mention of the chemicals used) (Di Colo, 1910).

In Fig. 2 we can see that Rosalia is much more similar in color to



Figure 2. Comparing three mummies (from the Cappuccini Catacombs in Palermo): Giovanni Paterniti, embalmed by A.Salafia (1911), Rosalia Lombardo, embalmed by A.Salafia (1920) and Antonio Prestigiacommo, died in 1844 and preserved with an arsenic bath.

In the pictures, Alfredo Salafia embalmed the first two mummies. Note how the color tones are different while Rosalia skin tone is rather more similar to that of Antonio Prestigiacommo a mummy of a century before embalmed by using arsenic. We can note also that Antonio Prestigiacommo is very well preserved compared to the mummies contemporary to him and shown in the catacombs. Arsenic was an efficacious embalming ingredient in the past embalming fluids but since it was a pollutant and also risky for health it was forbidden before in Europe (in the middle XIX century) and successively in the Usa in the early XX.

Prestigiacommo rather than to Paterniti. One reason could be that arsenic was used in her embalming, supposing she died from diphtheria, to avoid consequences for the embalmer. In fact, we can presume that it was not permitted by the Sanitary Law to embalm somebody who had died from a highly infectious disease such as diphtheria, since it was a very risky operation. A recent study (Sterling & al. 2000) demonstrated the transmission of *M. tuberculosis*

from a cadaver to an embalmer, confirming how dangerous it can be even today to embalm somebody who died from a highly contagious disease. For this reason I have always presumed that Rosalia's embalming was done without formal permission and, consequently, her body lacked the documents to be given a normal burial.

Why do I suppose the use of arsenic, if Salafia was already using formaldehyde, which was still in use at the time?

Also Giuseppe Paravicini, an embalmer contemporaneous with Salafia, used formaldehyde, as was discovered in 1980 when for first time his laboratory in the Mombello Hospital in Milan was examined (Carenzo, 1980). Nevertheless, in the Catacombs they were well acquainted with the use of arsenic as a powerful tool to kill bacteria and to fight highly contagious diseases (Farella, 1982). We can also suppose that Salafia was confronted for the first time with this specific situation, without having much time to think about his methods. Children decompose more quickly than adults, especially if the body fell prey to such powerful bacteria. Formaldehyde was a rather new substance, although paradoxically it was used to produce toxoid against diphtheria, the same year that Rosalia died. But that is another story: the road that would lead in twenty years to the defeat forever of diphtheria, a disease now totally forgotten but only half a century ago a real curse for children.

Conclusion.

A manuscript of Alfredo Salafia has been found, but it has not shed light on the particular case of embalming of Rosalia Lombardo. It seems that she is not even mentioned in that manuscript, as we can infer from a note to a book published in 2007 that quotes from the manuscript (Di Cristina & al., 2007). If this is the case, the question naturally

arises: why didn't Salafia write about this case? Many other questions still remain open on the causes of her death, since no scientific explanation has been given of the diagnosis of pneumonia, even though X-rays were taken of the little mummy. At the same time it cannot be assumed for certain that Salafia used the same formula for all the corpses he embalmed. If in his manuscript the case of Rosalia is not treated, then only laboratory analysis could give the answer. This paper presents several hypotheses based on historical research with the aim of raising doubts rather than giving certitudes. I leave the opportunity of following the traces that History left behind to those who have the opportunity to conduct a scientific investigation.

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