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THE 1854-55 CHOLERA PANDEMIC IN TUSCANY AND THE CHOLERA CEMETERY OF THE VILLAGE OF BENABBIO

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SUMMARY

THE CHOLERA CEMETERY OF BENABBIO IN TUSCANY

In the early 19th century the cholera endemic in Bengal spread to the West as an effect of the revolution in transportation resulting from the invention of the steam engine. Tuscany was struck in 1835 and then, even more violently, in 1854-55. Between 2007 and 2010, the Division of Paleopathology of the University of Pisa undertook the archaeological exploration of the cholera cemetery of Benabbio, a mountain village near Lucca, where the cholera lashed between August and October of 1855 causing 46 deaths in a population of around 900 inhabitants. The archaeological excavation of the cholera cemetery made it possible to detect for the first time the characteristics of these types of burials and provide a new resource for anthropologists and historians of medicine revealing the differences between persistent traditional local customs and regulations imposed by the religious and civic authorities.

Introduction

Archaeology is a fundamental source for the history of past pandemics[1]. The material culture study of catastrophe cemeteries can

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provide an original point of view of the cultural impact of mortality crises on human groups.
In this study, after having briefly illustrated the events of the cholera epidemic that struck Tuscany in 1854-55, we compare the measures imposed by the public authorities to contain the disease - especially as regards the treatment of corpses - with the evidence emerged from the archaeological excavation of the cholera cemetery of Benabbio, a village in the territory of Lucca, NW Tuscany.

The Pandemic of 1854-1855 in Tuscany

In the early 19th century the transport revolution, with the invention of the steam engine, and the political upheavals of Southeastern Asia, created conditions favorable to the spread of cholera outside the Bay of Bengal[2]. Cholera travelled along maritime, river, and rail routes, to the shores of the Eastern Mediterranean for the first time in 1823, and eventually affected Europe and Italy during the second pandemic of 1830-1837. In Tuscany, between August and October 1835, the disease mainly affected Leghorn, where it caused the death of 1171 individuals[3]. The speed of the disease was impressive: cholera, spread by water and by men, can cover long distances in a matter of months. It is believed that cholera has a speed of propagation from nine to sixteen times greater than that of the plague, although the morbidity and mortality of cholera are significantly lower[4]. From the onset of the disease the speed of propagation is rapid and can result in the death of its victims in a few days or even hours. The symptoms of cholera are dramatic: the infected person suffers from diarrhea and vomit resulting in extreme dehydration and muscle cramps; the consequent shock to the body causes the limbs to contract in a grotesque manner[5]. After the epidemic of 1849, which claimed few victims in Tuscany, the much more devastating pandemic of 1854-55 came, resulting in approximately 30,000 deaths throughout the Grand Duchy. Cholera was introduced in Tuscany on July 26, 1854 by a

small sailing ship from Genoa named "La Marianna", which docked at Avenza (Massa) and let off two infected persons on their way to Viareggio (Lucca), thus starting the spread of the disease in the Grand Duchy. At the same time other cases appeared in Leghorn and, from the coast, cholera spread towards the inner part of the region, following the path of the Arno and the new railway **"**Leopolda", which had been opened a few years earlier by Grand Duke Leopold II. From July to December 1854 in Tuscany 6452 cases were reported resulting in 3403 fatalities (53% of lethality)[6]. A great celebration thanking God for deliverance from cholera was held in Florence Cathedral on January 21, 1855.

However, cholera was only dormant and the disease exploded even more aggressively in February. This time it spread inside the region from the area of Sesto Fiorentino, just north of Florence, where many activities related to the water cycle, like laundries, dyers and several factories, aided the survival and new diffusion of the *Vibrio cholerae*. The disease flowed in the opposite direction from the previous year, gradually infecting the whole region. When the pandemic ceased in November 1855, the number of deaths amounted to 26,327 in one year. One of the most affected districts was Lucca, with 3,180 deaths. The morbidity levels oscillated between 2 and 4% in different districts of the Tuscan State, with the highest levels in the urban areas of Florence and Arezzo, lethality being around 53-55% [7].

Medical Debate on preventative Strategies and Tuscan Remedies

When the 1854-55 pandemic broke out, the real causes of cholera were almost ignored by medical science, and these were to remain uncertain until the identification of the Cholera bacillus, named *Komma Bacillus* by Koch in 1883. It was during the epidemic, in 1854, that the Tuscan anatomo-pathologist Filippo Pacini, specialized in the use of the microscope, discovered vibrios in the corps-

es of those who had died of cholera. He described the anatomical alterations, advancing the thesis of a link with the microorganism, which he called *Vibrio cholerae*, to the transmissibility of the disease[8]. His intuition, however, did not have an immediate sequel. The connection between clinic of infectious diseases and laboratory medicine would have been built much later, in the 1880s, when the methodological procedures developed by Robert Koch (the so-called Koch Postulates) - led to conceptualize the fundamental link between pathogenic microbial agents and contagious disease. At the time of the 1854-55 pandemic, the medical debate was catalyzed by two dominant theoretical positions: the contagion model and the anticontagionist theory. To summarize, the anticontagionists, influenced by the ancient miasmatic doctrines, held that cholera, and for example malaria, spread through the air via miasmas from infected areas characterized by poor sanitation, waste and stagnant water and "*rebus et corporibus putridis et corruptis*"[9]. The contagionists believed that the spread of the illness took place through human-to human contact by microscopic organisms. The idea of contagious transmission at that time was less successful; the contagionists were unable to demonstrate the existence of germs and to provide conclusive experimental proof of the contagiousness of cholera[10].

Between the two extreme positions, there was a series of intermediate theories that sought to conciliate the two points of view. Other theories stressed how the spread of the disease was preceded by abnormal astral conjunctions and comets, abnormal weather phenomena and earthquakes, that were defined as "sidereal-meteoric-telluric" changes in the medical writings of the time[11]. Ultimately, because of the lack of basic knowledge and experimental evidence, this long-standing etiological problem was never solved. The two theories not only caused conflicts in the academic world, but also had important political and economic repercussions in the contemporary world, affecting the policy decisions made to contain the devastat-

ing disease by public health authorities. The "liberal" States, such as France and Britain, supported the anticontagionist ideas and were generally opposed to the establishment of sanitary cordons, border controls and practice of quarantine, because these would limit trade and damage their commercial enterprises. These States preferred to concentrate on the improvement of degraded urban areas, creating efficient sewage systems, new aqueducts, and demolishing dilapidated buildings. Mediterranean States and the Hapsburg Empire, on the other hand, mainly supported the contagionists' view, and therefore established quarantine measures and sanitary cordons[12]. The scientific debate only partially influenced the practical choices of the doctors and health authorities fighting against the disease on the field. In general, they acted according to the idea that all dead bodies were potentially infectious. In this respect, paradigmatic appeared the behaviour of Pietro Betti, Public Health Consultant and Superintendent of the Grand Duchy of Tuscany. On the basis of his observations on the spread of the disease, Betti had become a strong advocate of the infectivity of cholera, but he implemented a series of preventive measures in the direction of environmental remediation in addition to control over the movement of the people infected. The measures included: isolation of the ill person in his house or in hospital; creation of hospitals only for the sick of cholera, with separate sectors for the ill and for convalescents; disinfection of the houses, furniture and objects belonging to the sick; prohibition of butchery products and selling of pork meat; disinfection of the lavatories and sewers; regulation of the burials[13]. Numerous measures were imposed to regulate the burials of the cholera victims, considered dangerous sources of infection, especially during the process of putrefaction of the body, when there was the risk of the soil raising contagious "putrid emanations". Firstly, there was the choice of the place, away from the town. This necessity, already developed in the 18th century by hygienists and illuminists, was welcomed by the new laws enacted for Italy by

Napoleon in 1806. These laws had been applied especially in the urban areas of Tuscany, while there was often a perilous continuity between cemeteries and churches of the village in rural areas[14]. The provisions in force in the Grand Duchy at the time of cholera were established in 1835, in addition to the need to transport the body in coffins or in perfectly closed wagons: to lay a single body for every burial ditch; to lay the body naked, with no coffin nor shroud; to lay at least one "staio" (i.e. 24.36 litres) of strong lime on the body. Exceptions were made for the foreigners of the Anglican rite, who could use the coffin, but with no cover and with a double layer of lime between the body and the coffin; furthermore, the ditch was half a "braccio" (i.e. 0.583 meters) deeper than normal. We know that especially the need to bury naked bodies generated protests by the priests and the population as public decency attack, but the authorities were adamant in applying the rule[15].

The Cholera Cemetery of Benabbio

To verify the choices made in practice under the pressure of epidemic emergencies, the Division of Paleopathology of the University of Pisa undertook, between 2007 and 2010, the archaeological exploration of the cholera cemetery of Benabbio, a mountain village near Lucca, where the cholera lashed between August and October of 1855, causing 46 deaths out of 71 ill people in a population of around 900 inhabitants (7.9% of morbidity, 5.1% of mortality, 65% of lethality)[16]. The emergency to bury infective bodies led to choose a site separate from the village as a burial place, and the choice fell on the area of the ancient abandoned medieval Castle of Benabbio, on top of the hill overlooking the modern village. It was decided to bury the bodies around the medieval church of St. Michael, which was the only surviving building of the ancient Castle as simple rural Chapel. The choice was not arbitrary, but dictated by two different needs: 1) to remove the dead from the village, the cemetery of which was in the centre, close

to the parish church, and consisting of walled structures for collective burials, where the bodies were buried without being covered by earth. 2) to preserve Catholic rituals, using a ground consecrated by the proximity of a church. The archaeological excavation made it possible to unearth 43 bodies and to detect the material characteristics of a cholera cemetery for the first time. The arrangement of the cemetery area reflects its planning: the tombs are distributed in ordered rows, designed to occupy the space of the courtyard and along the SW side of the church (Fig. 1). The average depth of the graves is considerable, about 0.9 m, while the width is very modest, often not exceeding 0.5 m. Only six burials show layers of lime below and above the body of the deceased, but usually in amounts lower than that mentioned in the prescriptions. The bodies, as evidenced by taphonomic observation and by impressions on the layers of the lime, had been placed in shrouds; some wore clothes, as evidenced by the discovery of buttons and remains of textile not attributable to the shroud. In some graves the bodies had been deposited with the coffin, or more

Fig. 1. Benabbio (Lucca), Italy. The cemetery of cholera at the end of the archaeological excavation by aerial view. The regular disposition of burials around the church of St. Michael is well visible.

Fig. 2. Two examples of burials from the cemetery of cholera of Benabbio (Lucca), Italy. Note the abnormal and unconventional posture of the bodies, the small quantity of lime on the bodies and the modest width of the graves.

likely with the wooden boards used by the undertakers for the transportation of the body, and then lowered into the grave. The posture of the deceased is "abnormal" compared to the ordinary Catholic burials involving the supine body, with its arms folded across the belly (Fig. 2). In many cases the bodies show cowering positions, with the limbs bent and distort, sometimes in prone position. In our opinion, this is caused by two factors: the rush of burial and the maintenance of the position that the individuals employed during the final stages of

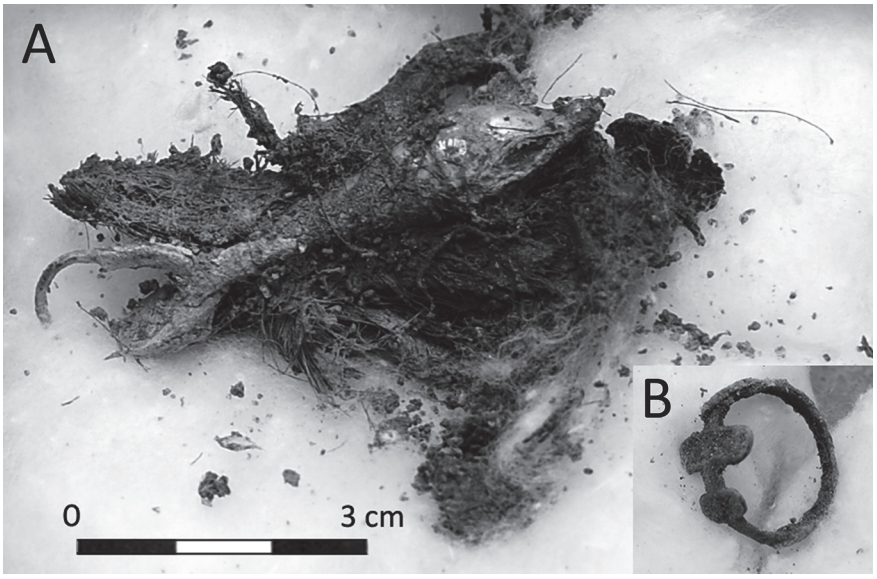

Fig. 3. Benabbio (Lucca), Italy. Objects with apotropaic meaning found in two different burials of cemetery of cholera as parts of the personal apparatus: a silver pendant having a shape like fish (A) and a copper ring with Lorrain cross (B), commonly used as talismans against diseases.

the disease, with the limbs contracted in a grotesque manner. In five ditches there were two individuals buried together. Finally, personal apparatus (earrings, pendants, rings), and devotional objects (rosaries and bronze medallions) were identified in some burials. In some cases these were objects with evident apotropaic meaning, as for example a copper ring with Lorrain cross or a silver pendant shaped like fish (Fig. 3)[17].

Conclusions

In Tuscan rural areas the local resistance against the dictates imposed by the health authorities is manifested in several ways. The presence in the burials of clothes and jewelry, personal or devotional, reflects the need to respect the standard popular religious ritual. The

use of shrouds, which was generalized, explicitly goes against the law imposed by the State, which was to lay the body naked. Other features of the inhumations seem to depend on the speed with which the gravediggers buried the corpses. This fact can explain the abnormal position of the bodies, the under-representation of lime, that is attested only in six burials and never reaches the amount prescribed by the law, and also the presence of wooden boards used as stretchers to carry the dead and then left in the ditch directly below the body. Material reality coincides only partially with the keynote orders of the authorities, revealing a form of autarchic and popular resistance to the application of the rules, certainly influenced by religious rituals, but not free from apotropaic and superstitious instances.

Appendix

Paleomicrobiology of cholera: skeletal remains as a resource for microbiology?

The genome of the *Vibrio cholerae* strain from the Philadelphia Cholera outbreak cemetery of 1849 was reconstructed in 2014. By using targeted high-throughput sequencing, the researchers of the McMaster Ancient DNA Centre of Toronto sequenced the *Vibrio cholerae* genome from a special tissue specimen stored in the Mütter Museum Collection of Philadelphia[18].

The study reveals that the strain of the Philadelphia specimen has 95 to 97% similar to the classical 0395 genome, differing only by 203 SNPs. This study demonstrates the importance of archived medical remains as a resource for genomic research on the origins of past pandemics, but it also reveals the need to dispose of very-well preserved soft tissue of the intestine for the molecular analysis of cholera. It currently seems impossible to be able to obtain positive molecular results from archaeological skeletal remains. *Vibrio cholerae* does not have a systemic diffusion in the human host, and the soft tissue of the intestine in the burial soil is subject to complete decay.

From this point of view, the human skeletal remains of Benabbio are not suitable for molecular investigation on the cholera genome, but they can be used to analyze other molecular components to establish the microbiome of a population affected by cholera and the probable interaction with the pathogen. The oral microbiome, for example, can be studied by dental calculus, to verify a possible predisposition in individuals who have contracted the disease compared to those who have not[19].

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