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Research Article

Retrospective Pathogen Investigation of the 1867–69 Ichampally , Godavary River Outbreak: Was it Cholera or a Zoonotic Viral Spillover?

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ABSTRACT

The Ichampally Project site (18°38′04″N 80°19′26″E), located on the Godavari River in present-day Telangana, India, witnessed a catastrophic and mysterious outbreak between 1867 and 1869 that led to the abrupt abandonment of an ambitious river infrastructure project under Nizam Afzal ad-Dawlah. This study integrates field observations, oral histories, and archival research to reconstruct the historical outbreak that claimed the lives of approximately 2,000 laborers and 30 European engineers. The rapid onset and mortality pattern, with deaths occurring within 1 to 3 days, suggest a virulent pathogen, potentially viral and waterborne in origin, distinct from the first officially documented Indian plague epidemic in 1896. Field investigations in 2015 and 2023 revealed scattered skeletal remains and damaged graves at the site, supporting the scale of the tragedy. This research highlights the diagnostic limitations of the 19th century, when cholera-like syndromes were recognized solely based on clinical symptoms. Drawing parallels with contemporary zoonotic spillover risks, we propose that next-generation sequencing (NGS) and ancient DNA (aDNA) analysis of well-preserved skeletal remains could identify the causative pathogen. Preliminary plans for pathogen DNA extraction from dental and inner ear bone samples aim to reconstruct the genome of the infectious agent. Such a discovery could clarify the etiology of the Ichampally outbreak and reveal connections to modern zoonotic pathogens, emphasizing the relevance of historical epidemiology for present-day outbreak preparedness.

1. Introduction

Ichampally project site located downstream from the confluence of the Indravati and Godavari Rivers in the Karimnagar district of Telangana (18°38′04″N 80°19′26″E). Ichampally project was the ambitious vision of Nizam Afzal ad-Dawlah, Asaf Jah V, Mir Tahniyath Ali Khan, and a team of European engineers. In the 1860s, the Nizam initiated an effort to construct a river crossing on the Godavari River. However, this undertaking met with a tragic end due to a mysterious outbreak, often believed to be a unknown outbreak. On within 3 days, nearly 2,000 workers and 30 European military engineers reportedly succumbed to the illness, leading to the project's abandonment. The remnants of the project can still be found at the site, along with several graves marking the final resting place of the European engineers who perished during the outbreak. This unfinished project and the haunting presence of the graves stand as silent witnesses to the scale of the tragedy that halted one of the Nizam's grand infrastructural dreams. The nature and origin of the disease that caused the outbreak remain unknown, as the medical knowledge and diagnostic capabilities of the time were limited, leaving the illness uncharacterized. Historical records suggest that environmental and ecological factors in remote, resource-limited areas often exacerbate health risks during large-scale infrastructure projects (Drexler et al., 2012; Wolfe et al., 2007). This incident at Ichampally is a stark reminder of the unique challenges faced in such isolated project settings, where minimal access to medical resources and lack of crisis preparedness can significantly magnify the effects of unforeseen epidemics. The study of such historical outbreaks is crucial for understanding the risks associated with zoonotic spillover in ecologically diverse regions, especially as they relate to modern infrastructure development. Lessons from the Ichampally tragedy underscore the need for improved health surveillance and emergency preparedness protocols in remote and high-stakes developmental ventures.

2. Methods

In March 2015 and 2023, a field visit to the Ichampally project site located downstream from the confluence of the Indravati and Godavari Rivers in the Karimnagar district of Telangana (18°38′04″N 80°19′26″E) (Fig:1) was undertaken to gather first hand information regarding the historical 1867-69 outbreak and its lasting impact on the local community The investigation began with an exploration of the site itself, focusing on identifying locations associated with the outbreak and examining any remnants of the 19th-century infrastructure and burial sites. This exploration was complemented by semi structured interviews conducted with local residents, particularly elders and community members with knowledge of oral histories that have been passed down. These interviews offered qualitative insights into the local lore, memories, and perspectives regarding the outbreak and the events that followed. In addition, a examination of the burial site of the European engineers who perished during the outbreak was conducted.

Observations included noting inscriptions, structural layout, and any memorial markers present. Photographs and descriptive notes were taken to document visual and spatial details, which provided critical context for the historical narrative surrounding the tragedy. During the interactions with locals, audio recordings and written notes were used to ensure an accurate capture of both verbal expressions and contextual observations, preserving the richness of the data collected. To supplement the field observations, historical records related to the Ichampally project and the 1867-69 outbreak were reviewed. These archival sources provided a broader framework within which the collected on-site data could be understood, enhancing the depth of the field notes. The combination of field exploration, interviews with the local community, and analysis of historical records provided a comprehensive approach to understanding the impact and significance of the 1867-69 outbreak at the Ichampally project site.

3. Results and Discussion

During the field observation at the Ichampally project site, numerous skeletal remains were found surfacing along the banks of the Godavari River. These skeletal remnants, believed to be from the tragic 1867-69 outbreak, were scattered and partially exposed, indicating possible disturbances due to environmental factors, excees flow of godavari river or human activity over time. Additionally, an assessment of the burial site dedicated to the 30 European engineers revealed extensive damage. Out of the 30 graves, 20 were found in a compromised state; covering slabs had been displaced or removed, and nameplates were missing, further complicating the identification and preservation of the individual graves..

The damage to the graves and absence of identification markers present significant challenges to efforts aimed at memorializing and documenting the historical tragedy that occurred at this site. The tragic outbreak of 1867-69 at the Godavari Ichampally Project Site, which claimed the lives of both local inhabitants and European engineers, offers a unique opportunity for retrospective pathogen analysis. The first authenticated plague epidemic in modern India occurred in 1895-96, with the disease gaining prominence from 1898 and peaking in 1907 (S.C.Seal,1969). However, at the Ichampally site on the Godavari River, an outbreak was reported as early as 1867-69. Given this timeframe, the outbreak at Ichampally may not have been related to plague. According to local lore, the fatalities occurred rapidly, within 1 to 3 days, suggesting that the cause may have been a severe viral outbreak possibly waterborne in nature. This rapid progression warrants further discussion on the potential origins and nature of this historical outbreak. Interestingly, the diagnostic practices during that period were vastly different from today's standards. Insights from W.R. Cornish's 1869 report on "Cholera in Southern India" reveal that diagnosis relied almost entirely on clinical observation. Cholera cases were identified by characteristic symptoms such as sudden severe diarrhea, vomiting, rapid dehydration, cramps, and death within hours to 1–3 days. Medical staff and local leaders recognized cholera based on patterns of symptoms, absence of other causes, and outbreak clusters. There was no microbiological confirmation or laboratory testing; instead, outbreak recognition was often based on the sudden collapse of health in a community. Eyewitness reports and symptom descriptions by village elders and coolies were often the only basis for declaring a cholera outbreak.

No laboratory tools or bacteriological techniques were used, as cholera's bacterial cause (Vibrio cholerae) had not yet been widely accepted or isolated in India. Diagnosis thus stemmed from shared knowledge of symptoms and environmental cues, such as contaminated water sources, unsanitary conditions, and proximity to infected individuals. These insights help contextualize the diagnostic uncertainty at Ichampally, where the rapid progression of symptoms and high fatality rate (with most deaths occurring within 1 to 3 days) might have mimicked cholera. However, absence of confirmation or cholera's known epidemiology in that region makes a respiratory or waterborne viral cause more plausible.

Additionally, the cholera records of the period indicate a series of devastating outbreaks in Hyderabad and adjacent regions during the years 1857, 1863, 1867, 1869, and finally 1870, after which the epidemic subsided. (W.R. Cornish's 1869) Among these, the 1867–69 period marked particularly intense mortality events. Mortality in some areas reportedly exceeded 50%, especially among children. Children displayed a range of symptoms including diarrhea, vomiting of worms, fever, and cerebral disturbances conditions that were rapidly fatal, often resulting in death within 1 to 3 days. These manifestations, described in Cornish's official medical observations, highlight the severe neurological complications and rapid disease progression that further obscure distinctions between cholera and other possible pathogens. This historical clinical data lends weight to the hypothesis that Ichampally's outbreak may have involved a mixed etiology or an unidentified viral pathogen capable of producing similar rapid systemic collapse.

By examining the skeletal remains of the European engineers, particularly through genomic DNA extraction from teeth, inner ear, and spinal cord samples, it may be possible to uncover clues about the pathogen responsible for this deadly event. Advances in ancient DNA extraction and next-generation sequencing (NGS) technologies have opened new avenues for pathogen discovery in historical remains, providing insights into past outbreaks and potential connections to modern infectious diseases.

The first step in this analysis involves carefully extracting DNA from the well-preserved areas of skeletal remains, such as the teeth and inner ear. These areas often protect DNA from

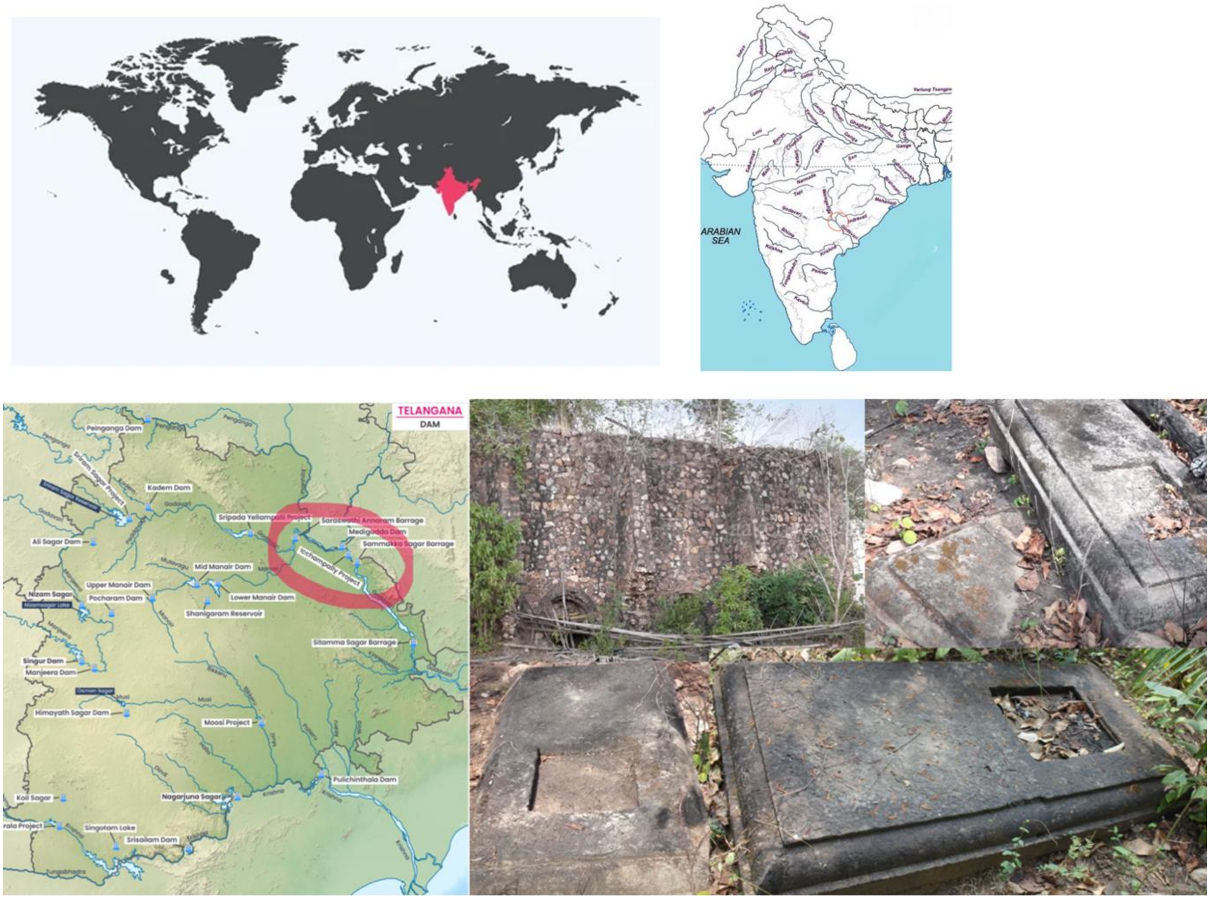

Fig 1. Ichampally Project site and Burials

environmental contamination and degradation, making them ideal sources for ancient DNA studies (Kemp & Smith, 2005; Pinhasi et al., 2015). Following extraction, next-generation sequencing allows for comprehensive genome sequencing, which can capture even fragmented DNA sequences. Once the sequences are obtained, bioinformatic methods can be applied to filter out human DNA, isolating pathogen sequences from any bacterial or viral origin (Schuenemann et al., 2013). This approach has been successfully applied in previous studies to reconstruct genomes of ancient pathogens, such as Yersinia pestis from medieval plague victims (Bos et al., 2011) and Mycobacterium zzleprae from leprosy-affected individuals (Schuenemann et al., 2013).

Identifying the pathogen responsible for the 1867-69 Ichampally outbreak would provide valuable insights into its origin and epidemiology. For example, if a viral genome is identified, it could indicate zoonotic transmission from local wildlife, a hypothesis that aligns with known patterns of virus spillover from wild animals to humans, particularly in remote, high-biodiversity areas (Wolfe et al., 2007; Morse et al., 2012). This type of analysis could not only elucidate the origins of the Ichampally outbreak but also help link it to any similar pathogens causing modern or emerging infectious diseases. Any correlation with existing zoonotic viruses would suggest a longstanding presence in the environment, underscoring the importance of monitoring wildlife reservoirs to prevent future outbreaks.

Moreover, comparing the identified pathogen genome with databases of known pathogens could reveal genetic traits associated with virulence, transmission mechanisms, and environmental resilience. This knowledge would be invaluable for developing early detection systems for future outbreaks, particularly in regions where environmental and ecological conditions favor pathogen spillover (Drexler et al., 2012). Pathogen genome reconstruction from historical remains has proven to be a crucial tool for understanding the evolution and spread of infectious diseases, as evidenced by the historical analysis of influenza and coronaviruses (Taubenberger & Kash, 2010, Vashisht et al., 2023).

4. Conclusion

The application of next-generation sequencing to the skeletal remains from the Ichampally project site has the potential to identify the pathogen responsible for the 1867-69 outbreak. By studying this pathogen, we may gain insights into the disease's origins and inform strategies for preventing future outbreaks. This research approach emphasizes the importance of integrating ancient DNA analysis with modern bioinformatics and epidemiology, contributing to the broader field of historical pathogen genomics and preparedness for emerging infectious diseases.

Conflicting Interests

The authors have declared that no conflicting interests exist.

Authors Contributions

Muttineni Radhakrishna – Field Visit, Concept design and Manuscript Writing
Siripuram Jhansi Rani – Field Visit.

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