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Antibiotic Treatment for the Plague

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Abstract

The lethal plague, which is brought on by the bacteria *Yersinia pestis*, continues to be a problem for global public health. The bubonic plague, septicemic plague and pulmonary plague are the three primary clinical types. The signs and symptoms of all three kinds all emerge out of nowhere and worsen extremely quickly. Early antibiotic treatment is crucial for fighting the illness. Several families of antibiotics, including tetracyclines, fluoroquinolones, aminoglycosides, sulfonamides, chloramphenicol, rifamycin and beta-lactams, have shown effectiveness in various animal models and are active in vitro against the majority of *Y. pestis* strains. There have been a few documented inconsistencies, though. As a result, various medications have been licenced or suggested for use in treating or preventing disease. Currently, only monotherapy is advised; case reports or preclinical studies have demonstrated no benefits from combined medication. apprehensions regarding the rise of drug-resistant New families of antibiotics and other treatments have been created as a result of strains of *Y. pestis* (e.g., LpxC inhibitors, cationic peptides, antivirulence drugs, predatory bacteria, phages, immunotherapy, host-directed therapy and nutritional immunity). It is challenging to predict which of the currently developed medicines or treatments will be most efficient for a certain form of plague. This results from inconsistent data from case reports, a lack of standardisation in preclinical studies and a dearth of clinical trials to date.

Keywords: Utritional immunity • Plague • Antimicrobial chemotherapy • Multidrug resistance • Immunotherapy

Introduction

The fact that the plague has produced three pandemics and consequently disrupted the political, social, economic, cultural and religious orders makes it one of the most infamous and feared diseases. According to estimates, the pandemic killed more than 150 million people worldwide. The number of plague cases has, however, declined over time. In the early 20th century, the plague killed hundreds of Europeans, whereas in the Middle Ages, it killed millions. The final known instance in France was noted in 1945. Therefore, it is not unexpected that many Europeans believe the plague to be a scourge of the past and extinct. However, 11 nations in sub-Saharan Africa, Asia and the Americas reported about 3000 human instances of plague to the world, proving that this is untrue. Between 2013 and 2018, the World Health Organization (WHO). Of these, Madagascar and the Democratic Republic of the Congo were responsible for 80% and 15%, respectively, of all plague cases worldwide. Keeping in mind that plague is mostly spread by rodents and their fleas, only a small number of the 200 species of rodents and lagomorphs and 80 species of fleas that have been linked to the disease are regarded significant hosts or vectors (see for a brief overview of plague epidemiology). In contrast to epidemics in humans, outbreaks in the animal reservoir are distributed differently geographically.

Only 10 of the 33 nations where an animal plague focus had been identified at some point in the previous 30 years reported human infections between 2013 and 2018. Consequently, the resurgence of human After years of silence, the persistence of plague in some regions where the disease is thought to be extinct may be a sign of an active but remote old animal reservoir. This could be one reason why the human disease returned to Algeria and Libya after a 20–50 year absence. In any event, plague cases in formerly disease-free areas and data from animal surveillance imply that the plague's range is expanding. In addition to this natural hazard, it is extremely concerning that people or governments could employ the plague bacillus for terrorism or conflict, as has already happened in the past. Finally, the outbreak of new diseases increases the risk of the plague. of strains that are resistant to the preferred antibiotics for disease control or the potential use with malicious intent of strains that have purposefully become resistant to every available treatment option. As a result, numerous research teams are creating anti-plague tactics [1].

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Subjective Heading

Antimicrobial chemotherapy

Antibiotic therapy for infectious illnesses has a long history. However, when arsphenamine was employed to treat syphilis little over a century ago (in 1911), the concept of chemotherapy utilising pure or synthetic chemicals first developed. Between 1932 and 1987, around 15 families of antibiotics with various modes of action were discovered after this discovery and that of penicillin in 1928 The 1940s, 1950s and 1960s were considered the "golden period" of antibiotic discovery. The most recent class of antibiotics with activity against Gram-negative bacilli was released in the late 1980s, despite the fact that known compounds have been enhanced since then. Unquestionably, the use of antibiotics has significantly lowered the number of plague patients who pass away. Although, early Administration is still crucial [2].

Patients who contract the bubonic form of the plague are more likely to survive even when given antibiotics known to be effective: after receiving antibiotic treatment, 10% to 30% of patients with bubonic plague and 30% to 50% of patients with pneumonic or septicemic plague will still pass away However, a recent meta-analysis of pneumonic plaque-related deaths and information from Madagascar's significant pneumonic plague epidemic in 2017 showed that the mortality rate for people with confirmed or likely pneumonic plague was between 8 and 25%. Combinations of antibiotics have been given to several patients. This method (such as a streptomycin and chloramphenicol combination) was necessary in a few instances where the patients resided in an area where a streptomycin-resistant strain had been reported.

In other instances, patients were given a mixture of medications in order to boost the likelihood of survival due to the potential additive or synergistic effects of the treatments. However, previous to the diagnosis of plague,

the majority of patients were treated for a life-threatening infection with an empirical combination of antibiotics. Although many patients have received these combinations, none of them seem to be more efficient than the others. For instance, tetracycline alone had a higher survival rate than a combination of aminoglycosides and tetracycline. Additionally, keep in mind that combining antibiotics can make adverse effects and drug interactions more common. Certain antibiotic combinations may have adverse effects and perhaps impair the patient's prognosis due to an accumulation of toxic effects or antagonistic interactions. As a result, the current recommendations for treating plague are dependent on preclinical and clinical data that aren't entirely trustworthy as well as on the availability of antimicrobial medications in the relevant nation Streptomycin and tetracycline, which were recommended by the WHO, have been replaced in the USA and France, respectively, by gentamicin and doxycycline [3].

Antibiotic resistance

Different *Y. pestis* strains have been recovered from patients and rodents for many years, despite being resistant to the prescribed medicines. According to genetic studies, three different conjugative plasmids are responsible for mediating this antibiotic resistance (pIP1203, pIP2180H and pIP1202). Streptomycin and doxycycline monoresistance are encoded by the pIP1203 and pIP2180H, respectively. The third plasmid (pIP1202) gives resistance to eight antibiotics, including streptomycin, tetracycline, chloramphenicol and sulfonamides, which are all employed as the first-line curative and preventive treatments for plague. The source may have been Enterobacteriaceae in the flea gut, even if the precise origin, the method of acquisition and the date of acquisition by *Y. pestis* have not been identified. The pIP2180H is similar to the pB71 strain of Salmonella enterica, in fact. belongs to the plasmid IncH1 group. The pIP1202 also shares sequence homology with the Yersinia ruckeri fish pathogen and numerous Enterobacteriaceae (including Escherichia coli, Klebsiella spp., and Salmonella spp.) implicated in the contamination of farmed beef in the USA.

Additionally, in the flea midgut, pIP1202 is easily transferred from E. coli to *Y. pestis*. Therefore, there should be some concern about the potential emergence, spread and maintenance of multidrug-resistant *Y. pestis* strains in endemic areas given the abundance of an MDR conjugative plasmid (pIP1202-like) in farm animals and the potential high transfer rate in infected tissues (such as the flea midgut). The Mongolian *Y. pestis* strain is even more dangerous than a strain that carries pIP1202 because because demonstrates resistance to every antibiotic currently being used, excluding fluoroquinolones. The precise makeup of the multi-resistance mechanism is still unknown. Finally, the employment of *Y. pestis* strains that have been modified to be multidrug resistant (MDR) in conflict or terrorism cannot be ruled out. Therefore, there is a critical need for novel therapeutic approaches that can shield populations against accidental or purposeful *Y. pestis* infection [4].

Discussion

The late stages of plague offer minimal protection from antibiotic therapy. This is most likely due to the host's inability to control a negative inflammatory response brought on by *Y. pestis*' quick spread throughout the host. Therefore, reducing inflammation may be a way to increase plague patients' chances of survival. Since the immune response is necessary for efficient bacterial clearance, this suppression must be mild. Using a mouse model of the bubonic plague, Levy et al. tested the aforementioned theory. They claimed that *Y. pestis* protection was not provided by an anti-inflammatory molecule alone, but rather by a modest corticosteroid treatment in conjunction with the delivery of anti-Y. pestis antibodies. Numerous anti-infective research initiatives have recently concentrated on the creation of compounds that target host mechanisms or channels that are employed by the infecting pathogen. Host-directed therapies are far less likely to trigger the development of resistance than compounds that target the infectious agent, making them an option for treating infections caused by MDR bacteria. It has been hypothesised that the chemical L-97-1, which blocks the adenosine A1 receptor, can offer defence against pneumonic plague. The antagonist would stop the release of immune-suppressive compounds that cause acute lung injury after *Y. pestis* lipooligosaccharide binds with the adenosine A1 receptor by killing endothelial cells [5].

Conclusion

The evidence from in vitro studies, animal models, case studies and the few published clinical trials indicates that a number of medications that have been given the green light by health authorities have preventative or therapeutic effects against the plague in people. In addition to the arsenal of powerful medicines we currently possess, MDR strains of *Y. pestis* have prompted the development of novel antibiotic classes and treatment approaches for the plague. Some of these cutting-edge tactics are currently undergoing late-stage clinical testing and seem to have therapeutic potential. The most efficient therapies for each of the several plague types are impossible to foresee, though. This is brought on by the dearth of clinical studies that have been carried out and the unstandardized use of animal models. In In the future, standardised human tissues and/or microfluidic organoids may be used as a novel method to forecast which therapies will be successful. It should be remembered, nonetheless, that standardisation does not imply restriction. For instance, it will be possible to identify the most efficient treatment for additional investigation in a clinical trial the only way to arrive at a firm conclusion by testing a variety of regimens, dose levels, inoculation routes, bacterial strains, bacterial growth conditions, animal species and animal strains. However, there are clear ethical difficulties raised by clinical studies in the setting of the plague.

Acknowledgement

None

Conflict of Interest

None.

References

1. Bos, Kirsten I., Verena J. Schuenemann, G. Brian Golding and Joseph B. McPhee et al. "A draft genome of *Yersinia pestis* from victims of the Black Death." *Nat* 478, (2011): 506-510.
2. Haensch, Stephanie, Raffaella Bianucci, Michel Signoli and Marco Vermunt et al. "Distinct clones of *Yersinia pestis* caused the black death." *PLoS pathog* 6 (2010): e1001134.
3. Bramanti, Barbara, Katharine R. Dean, Lars Walløe and Nils Chr. Stenseth. "The third plague pandemic in Europe." *Proc R Soc B* 286 (2019): 20182429.
4. Bertherat, Eric and É. Bertherat. "Plague around the world in 2019." *Wkly Epidemiol Rec* 25 (2019): 289-292.
5. Bitam, Idir, Saravanan Ayyadurai, Tahar Kernif and Michel Drancourt et al. "New rural focus of plague, Algeria." *Emerg Infect Dis* 16 (2010): 1639.

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