

The epidemic of Athens, 430 - 426 BC

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The Athenian epidemic of 430 - 426 BC, at the outbreak of the Peloponnesian War, caused the death of the great statesman, Pericles, decimated the population and contributed significantly to the decline and fall of classical Greece. In his remarkable documentation of the epidemic, Thucydides (who survived the disease) not only left us a clear clinical picture of the pestilence but also identified its infectious nature and the fact that it conferred at least partial immunity on survivors. As confirmed by a large number of scholars who studied the subject, Thucydides' description does not accurately fit any existing disease, but we suggest that analysis of the signs and symptoms, considered in conjunction with significant epidemiological evidence, narrows down the many possibilities to epidemic typhus, plague, arboviral disease (e.g. Rift Valley fever) and smallpox. Typhus and smallpox fit best, but we favour the latter for reasons given. Unless further primary sources of information become available (and this seems most unlikely), productive speculation as to the cause of Thucydides' epidemic has probably reached the end of the road.

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In the year 430 BC, a few months after the outbreak of the Peloponnesian War, a devastating epidemic struck Athens and surrounding Attica, killing at least one-quarter of the population.¹⁻⁶ It is probably the best documented epidemic of ancient times and contributed significantly towards the fall of classical Greece. It heralded the end of the 'Age of Pericles' when the great statesman died during the epidemic in 429 BC, although Athens was still to enrich Western civilisation through subsequent contributions by Sophocles, Euripides, Plato, Aristotle and others.

In his *The Peloponnesian War*, book 2 (chapters 47 - 52), Thucydides gives a detailed description of the epidemic,¹ and over the past 500 years scholars have attempted to identify the disease. This has led to more than 200 publications and even a panel discussion at the annual meeting of the American Philological Association in 1984.⁴

No final consensus has been reached, but excellent reviews have been published.²⁻⁴ Instead of attempting to

cover the whole field, this paper will provide a general overview and a discussion of the most likely diagnostic options.

The author

Thucydides' classic description is our only primary source of reference, although a number of subsequent writers and historians added to the story. For instance, Diodorus Siculus (1st century BC),⁹ relying on the informant, Ephoros, gives additional information which often clashes with Thucydides' description; its veracity, however, is open to serious doubt. Similarly, Lucretius (1st century BC)^{9,10} and Plutarch (1st century AD)⁹ wrote from hearsay at a much later date, while Galen (2nd century AD), with no further information at his disposal, tended to be critical of Thucydides, comparing him unfavourably with Hippocrates.⁸ Aëtius (390 - 435 AD) and others record the legend (certainly apocryphal) that Hippocrates aborted the epidemic by lighting a huge bonfire.¹¹

A soldier and noted classical historian, Thucydides (460 - 400 BC) survived an attack of the Athenian disease.¹ His description of the epidemic is among the great medical contributions of ancient times. He wished to leave to posterity an accurate picture of the epidemic, so that it could be recognised if it ever recurred. Page¹ points out that although Thucydides was not medically trained he was certainly familiar with the writings of the Hippocratic school — and it should be kept in mind that the total volume of literature available to an educated 5th-century Athenian would have contained a significant medical component.¹² Characteristic of the Hippocratic tradition, Thucydides described what he saw, concentrating on prognosis rather than diagnosis, classification or speculation about the cause of disease.^{1,13} He said:

Each individual, whether doctor or layman, is free to relate his personal opinion about the origin of the plague, and the cause of this unprecedented disturbance, if he can find any powerful enough to account for it. For my part, I shall describe it as it was, and provide evidence in the light of which the student may have some knowledge in advance, and so have the best chance of recognizing it if it should ever recur.¹

Hippocrates was a contemporary of Thucydides, but there is no mention of this epidemic in the Hippocratic writings. Speculation that Thucydides, the historian, might have fabricated the epidemic in order to augment the impact of the disastrous events,^{3,14} has been thoroughly discredited.³ However, as a lay historian, he was describing a momentous medical saga to a lay public, and it is not impossible that his poetic style might have had some influence on the factual content of his story.^{1,3,12,14}

Athens and the Peloponnesian War (431 - 404 BC)

At the outbreak of the war with her Peloponnesian neighbours (mainly Sparta), greater Athens had an area of

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approximately 4 square miles, consisting of the harbour area of Piraeus connected to the mother city by Pericles' famous long walls.^{4,6} According to Gomme⁶ the enclave held 155 000 inhabitants (60 000 citizens, 25 000 metics, 70 000 slaves) before the war, housed in 10 000 dwellings. The total population of Attica was close on 400 000, fewer than half of whom were slaves, and indications are that it was a generally healthy community.⁹

In view of Athenian naval supremacy, excellent fortifications and good harbour facilities, Pericles decided to accept a siege without engaging the Spartans on land. The total population of Attica was brought into Athens, causing a population density of approximately 100 000 inhabitants per square mile with severe overcrowding (and very poor housing) in the long walls area, in particular.^{4,5,8}

The siege commenced early in the summer of 430 BC and initially lasted a year, during which time the Spartans laid waste the Attican countryside. Periodic sieges followed, but during the summer of 429 and the winter of 427/426 BC there was no invasion. In all, the war lasted 27 years before Athens capitulated in 404 BC. The epidemic of 430 - 426 BC undoubtedly had a severely demoralising effect and caused the death of the great Pericles, but Athens recovered sufficiently to sustain the war effort energetically, to counter-attack at sea and even to launch the unsuccessful offence against Syracuse in 414 BC. This disaster and the virtual destruction of their fleet in 405 BC were probably the main causes of ultimate defeat.^{1,4,8}

The epidemic

As pointed out by Page¹ any meaningful attempt at determining the cause of the epidemic depends on the accuracy of the translation of Thucydides' text. Not only must the original Greek medical terms be accurately translated, but their meaning in the fifth century BC must be determined. The following translation of relevant passages is widely accepted:^{1,15}

It was generally agreed that in respect of other ailments no season had ever been so healthy. Previous diseases all turned off into the plague; and the rest of the people were attacked without exciting cause, and without warning, in perfect health.

It began with violent sensations of heat in the head, and redness and burning in the eyes; internally, the throat and tongue were blood-red from the start, emitting an abnormal and malodorous breath. These symptoms developed into sneezing and hoarseness, and before long the trouble descended into the chest, attended by violent coughing. Whenever it settled in the heart,* it upset it, and evacuations of bile ensued, of every kind for which the doctors have a name; these also together with great distress. Most patients suffered an attack of empty retching, inducing violent convulsions, in some cases soon after the abatement of the previous symptoms, in others much later.

The body was neither unduly hot externally to the touch, nor yellowish in colour, but flushed and livid, with an efflorescence of small blisters and sores. Internally the heat was so intense that the victims could not endure the laying-on of even the lightest wraps and linens; indeed nothing would suffice but they must go naked, and a plunge into cold water would give the greatest relief. Many who were left unattended actually did this,

* Some scholars interpret *kardia* as stomach.

jumping into wells, so unquenchable was the thirst which possessed them; but it was all the same, whether they drank much or little. The victims were attacked throughout by inability to rest and by sleeplessness.

Throughout the height of the disease the body would not waste away but would hold out against the distress beyond all expectation. The majority succumbed to the internal heat before their strength was entirely exhausted, on the seventh or ninth day, or else, if they survived, the plague would descend to the bowels, where severe lesions would form, together with an attack of uniformly fluid diarrhoea which in most cases ended in death through exhaustion.

Thus the malady which first settled in the head, passed through the whole body, starting at the top. And if the patient recovered from the worst effects, symptoms appeared in the form of a seizure of the extremities: the privy parts and the tips of the fingers and toes were attacked, and many survived with the loss of these, others with the loss of their eyes. Some rose from their beds with a total and immediate loss of memory, unable to recall their own names or to recognize their next of kin.

For the peculiar characteristics of the disorder could not be described in words; and while in general it attacked each sufferer with a violence greater than human nature can bear, in the following point especially it showed plainly that it was something different from the diseases bred among us. All the birds and beasts that feed on human flesh, though many corpses lay unburied, either did not approach these, or perished after tasting them. As a proof of this there was a marked disappearance of such birds, and they were not seen either engaged in this way or otherwise; while the dogs, through their dwelling with men, gave a better opportunity of observing the effect on animals.

Thucydides gives further information relevant to the epidemic:^{1,15}

1. The disease apparently originated in Ethiopia and passed through Egypt, Libya and the greater part of the Persian Empire before reaching Lemnos and Athens via Piraeus. Elsewhere in Attica only the more densely populated areas were affected and then less severely than Athens. The Peloponnese was spared, and Spartan soldiers besieging Athens were not infected.

2. Thucydides noted that all segments of the population were affected indiscriminately, and that doctors (who knew no name or cure for the disease) were particularly hard hit. Depression was a prominent symptom. Overcrowding was blamed as an aggravating factor, but it must be noted that the epidemic recurred in the winter of 427/426 BC when Athens was not besieged.⁴ Thucydides clearly recognised the infectious nature of the disease and that patients who survived the illness were immune to further attacks or developed only mild recurrences.^{4,7}

3. The mortality rate of the disease among Athenian soldiers (hoplites) in Attica was 33%, and among soldiers in an expeditionary force to Potidea it was 26%.^{4,8,16} Quoting Diodorus Siculus, Bellemore *et al.* recently claimed that the mortality among commoners in the city was as low as 2 - 5%⁵ but, as stated elsewhere, the validity of Diodorus' information is questionable. Gomme⁶ calculated that the population of Attica decreased by 31% between 431 and 425 BC. According to Morens and Littman⁴ the epidemic's overall attack rate would have varied between 25% and 100% with a case fatality rate of approximately 25%.

4. Thucydides accentuates the horrors of the epidemic by his graphic description of resultant moral and social decline in the community under siege. Initially prayers were offered, and the gods and the oracles were consulted, but when all these activities proved futile, a widespread breakdown of traditional morality and restraints of law developed. The Greeks considered burial rites to be sacred and binding, but even these were abandoned and men were observed to leave corpses lying in the open or to toss them on top of already burning funeral pyres. Horstmannshoff¹⁷ feels that the degree of social decline might have been overstated by Thucydides and that much of it was precipitated by the teachings of sophists and opponents of Pericles, who claimed that his policy of overcrowding Athens had caused the epidemic.

5. The epidemic continued uninterrupted for at least 2 years (summer of 430 BC to summer or autumn of 428 BC), and then apparently died down but reappeared explosively in the winter of 427/426 BC. It was therefore not season-bound.

Discussion

Thucydides' description clearly does not accurately match any epidemic disease known today, but it does resemble some. Assuming that he recorded a valid description of an actual event, one could speculate that: (i) the Athenian epidemic was a disease which no longer exists; although medical history does record mysterious illnesses which apparently became extinct, like the English 'Sweating Sickness' (1485 - 1552) and 'Svette des Picards' (1718 - 1870), this is a rare occurrence;^{4,13} or (ii) the disease still exists but became modified over 25 centuries; this is a distinct possibility which would complicate present-day diagnosis; experience has shown that diseases usually become less virulent in time;⁷ or (iii) the disease has remained virtually unchanged — the descriptions of mumps and malaria in the Hippocratic corpus, for instance, are still clearly recognisable today.¹⁸ A further complication could be the simultaneous occurrence of more than one disease.³

At least 30 different disease entities have so far been suggested as possible causes of the Athenian epidemic.⁴ The majority of authors focused on finding a fit for the signs and symptoms described by Thucydides. These can be summarised as follows: Acute onset of severe pyrexial illness with initial inflammation of eyes and respiratory tract, followed by upper gastro-intestinal disturbance, a vesicular skin rash with open sores (there is controversy over the precise meaning of the Greek word *phlyktainai*, but majority opinion favours a skin rash with an element of blistering or ulceration) and death on the 7th (or 9th) day. Survivors of this stage developed watery diarrhoea and dehydration, which usually proved fatal. Those who recovered often developed peripheral gangrene of fingers, toes and genitals, loss of vision and total amnesia.

More recently scholars have stressed the importance of an epidemiological approach,⁴ pointing out that Thucydides should be credited for his pioneering recognition of the infectious nature of the disease and the fact that it conferred immunity against further fatal attacks. The important epidemiological aspects are as follows:

It was a previously unknown disease with an explosive onset (short incubation period), affecting all population groups, originating in Africa (Ethiopia and Egypt) and spreading rapidly to the Middle East and Greece (Athens via Piraeus, thus probably ship-borne); it was not seasonal but its spread was apparently dependent on population density; it waxed and waned but lasted approximately 4 years, had a mortality rate of 25% or more, and conferred at least partial immunity.

The possible transmission of disease to birds and animals of prey could suggest enzootic or epizootic involvement, but most authorities consider Thucydides' comments in this regard too vague for firm conclusions.^{2,4,16} However, his definite statement that animals who fed on corpses died afterwards remains an unsolved issue.

Descriptions of a severe epidemic in Rome (433/432 BC)⁹ and in the Persia of Artaxerxes (for which Hippocrates was consulted)¹⁹ provide corollary evidence of a pandemic in the Mediterranean basin.

Using modern epidemiological analysis, Morens and Littman⁴ came to the conclusion that the Athenian epidemic was consistent with either an infectious agent associated with an animal or insect reservoir, or respiratory transmission with a 'reservoir-like' mechanism ensuring persistent re-infection. This eliminates the vast majority of suggested disease entities, and almost all zoonotic diseases proposed, as the latter only affect humans accidentally ('dead end'), e.g. glanders, leptospirosis, rabies and tularaemia. On clinical grounds, anthrax is a possibility, but large-scale anthrax epidemics are not known to occur and no recognised reservoir is identifiable, as Athenian sheep and cattle had been dispatched to Euboea. According to Morens and Littman⁴ only epidemic typhus, plague, arboviral disease and smallpox would pass a screening procedure based on epidemiology. These diseases are also consistent with Thucydides' clinical picture of the epidemic, although all four present significant diagnostic difficulties.

1. **Epidemic typhus.** This louse-borne disease which, through the ages, has accompanied wars and famine, is the only favoured disease which typically causes gangrene of the extremities, as well as blindness and amnesia.²⁰ However, its characteristic skin rash is not bullous. Although lice occurred abundantly in ancient Greece and some authors claim that Hippocrates recognised typhus,²⁰ there is little evidence that the disease existed much before Cardan described it in the 16th century.²¹

2. **Plague.** This flea-borne disease with the rat as usual animal host was not endemic in classical Greece, but *Pasteurella pestis* almost certainly originated in ancient times in India and/or Africa in association with colonies of ground-burrowing rodents.²² The 'black rats' of Indian origin became its major vehicle of spread.⁹ There is some evidence that rats were uncommon in ancient Greece, and the Greek language had no word for rat (unless it is included under *mus*, the generally accepted word for 'mouse').²² The epidemic of Constantinople in 542 AD probably represents the first recorded plague epidemic — a disease which later created havoc as the 'Black Death' in medieval Europe.^{9,22} Plague classically manifests itself in either bubonic or septicaemic forms, but neither produces a bullous skin rash and Thucydides would certainly have commented on the striking and pathognomonic buboes of bubonic plague, had they been present.

3. **Arboviral disease.** Although Morens and Chu have suggested that the 4th and 5th Pharaonic plagues of Exodus 8 and 9, could have been Rift Valley fever,²³ this disease is generally considered to be of recent origin, first described in Kenyan sheep (1912). Human infection was recorded by Gear in 1951; originally considered a mild disease, later outbreaks in South Africa (1976) and Egypt (1977) carried considerable mortality.²⁴ Epidemiologically acceptable and characteristically affecting both man and animal, the clinical picture of Rift Valley fever (as the prototype of arboviral disease) resembles Thucydides' disease only vaguely. Other arboviral diseases like yellow fever and dengue have been considered, but are even less likely candidates.⁴

4. **Smallpox.** Sallares⁹ claims that the Egyptian Ebers papyrus (2nd millennium BC) may contain a description of smallpox, and that there is some evidence that Ramses V died of it in 1157 BC. Littman and Littman² postulate that smallpox has been endemic in Africa since ancient times. Its decisive role in the 'Elephant War' (7th century AD), and Rhazes' classic description in the 10th century¹⁹ established smallpox as an epidemic disease. The clinical manifestations of smallpox might well have undergone significant change over the past two millennia, but present-day smallpox still comes closest to the disease described by Thucydides. Its epidemiological features fit the Athenian disease, although more rapid extinction might have been expected.⁴ However, Morens and Littman⁴ point out that persistence of the epidemic over 4 years could be explained on the basis of reinfection of a closed 'virgin-soil' community (smallpox epidemics need a critical mass of 200 000 persons) by sporadic re-introduction to Athens of inhabitants from less densely populated areas of Attica, during lulls in the war. Peripheral gangrene is not characteristic of small pox *per se*, but severe systemic infection associated with diarrhoea and circulatory collapse late in the disease might have caused it. Some scholars consider the lack of mention of typical pox marks as significant evidence against this disease, but Littman and Littman² point out that Thucydides was describing the symptoms of the active disease while pock marks are later sequelae. It is also interesting to note that in his classic description of smallpox, Rhazes mentioned pock marks in only one of his patients. A very strong point in favour of smallpox is the bullous rash so clearly described by Thucydides — a hallmark of this disease.

5. **Other diseases considered.** Langmuir *et al.*¹⁶ postulated that the Athenian epidemic was not a single disease, but a combination of influenza and toxin-producing staphylococcal infection (the 'Thucydides syndrome'). From an epidemiological point of view, this particular hypothesis presents many problems but other scholars have also suggested multiple pathology,^{2,7,25} and this remains a distinct possibility, and very difficult to exclude.³

Other diseases considered include measles,^{1,3,26} which may cause devastating epidemics in 'virgin-soil' communities (as history has shown) but presents a different clinical picture and needs a critical population mass of at least 500 000 to cause an epidemic.¹⁷ From an epidemiological point of view, malaria is incompatible with the explosive epidemic described by Thucydides.⁴ Typhoid is water-borne and Athens did not have the centralised water supply system essential for an epidemic of this disease.⁴ Similarly, cholera and dysentery can be excluded on both clinical and epidemiological grounds.⁴

There have also been interesting suggestions that the epidemic might have been of a non-infectious nature. Kobert²⁵ and Salway and Dell²⁷ thought that ergotism could have been at least partially responsible for the epidemic, while Bellemore *et al.*⁵ present a well-motivated case for alimentary foenic aleukia caused by a mycotoxin's contamination of the Athenians' grain supply imported from the Black Sea area. However, the widespread nature of the pandemic as well as strong evidence of an infectious aetiology count heavily against this interesting hypothesis.⁴

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