[Reprinted from *Bulletin of the History of Medicine*, Vol. XXIX, No. 4, July-Aug., 1955.]

THE FIRST RECORDED EPIDEMIC OF PNEUMONIC PLAGUE: THE BIBLE, I SAM. VI *

S. H. BLONDHEIM **

Retrospective diagnosis of diseases and epidemics described in the Bible and ascribed to supernatural or even natural causation is at best uncertain. Many symptoms of pathognomonic importance undoubtedly escaped notice, or their significance was not appreciated, so that descriptions of diseases in the Bible are frequently too general or vague for diagnosis. Even where specific symptoms are mentioned, their meaning is often obscured in etymological confusion. Rendering the problem still more difficult is the possibility that some diseases of antiquity may have died out without ever having become known to medical history.

Occasionally, however, the diagnosis of a disease described in the Bible may be fairly apparent. Such is the case of the Philistine epidemic described in the fifth and sixth chapters of the First Book of Samuel. Most medical authorities (1-15) and modern biblical scholars (16-19) alike agree that this deadly disease which affected a maritime people, which was characterized by swellings in the "secret parts," and which was associated with swarms of mice or rats (*achbar*) was bubonic plague.[1]

The few who dissent include Neustätter (20-22), whose own interpretation was never published, and those authors (23-25) who have followed the often unreliable Josephus (26) in suggesting the diagnosis of (bacillary) dysentery. According to these authors the "swellings in the secret parts" were hemorrhoids. This interpretation has been effectively answered by MacArthur (14) who pointed out that "dysentery does not cause piles, people do not die of piles, and an epidemic of piles in any circumstances . . . is incredible; rectal prolapse is an occasional complication, but it is not common enough to colour the general picture of the disease." These authors reject the diagnosis of plague on the grounds that mice can not spread the disease. The argument is invalid since the word *achbar* signifies not only "mouse" but "rat" as well (27).

* Paper read at the Seventh International Congress of the History of Science, Jerusalem, August 1953.

** Hebrew University—Hadassah Medical School, Jerusalem, Israel.

[1] The buboes are variously translated from the original Hebrew *apholim* and its later Massoretic substitution *t'chorim* as "emerods" (hemorrhoids), plague-boils, swellings, or tumors.

Furthermore, it has been shown that the rat was present in Israel in the neolithic period (15).

The purpose of the present paper is to draw attention to the rarely noted epidemic of the Israelites of Beth-Shemesh (28) which closely followed the outbreak of plague among the Philistines. This epidemic, for reasons to be presented, appears to have been pneumonic, rather than bubonic plague, and thus constitutes the first recorded outbreak of this disease in medical history. It occurred 31 centuries ago (29). No other accounts suggestive of pneumonic plague are found until the plague of Justinian in the year 542 (8).

According to the biblical account, an epidemic struck the Philistines after they captured the Ark of the Covenant from the Israelites. The disease spread successively to each of the cities to which the Ark was taken, the last being Ekron. The Philistines, convinced that the wrath of the God of Israel was responsible for the plague that followed His Ark in its exile, returned the Ark to the Israelites. In addition, they sent as propitiatory offerings golden images of their buboes and of the " mice which destroyed the land." [2]

A deputation of Philistines brought the Ark and the golden offerings on a cow-drawn cart to Beth-Shemesh, the Israelite border-town nearest to Ekron. Here the cart was burned, and the cows sacrificed in its flames. Only after this ritual was completed did the Philistines withdraw to their own land (30). Thus, they remained at Beth-Shemesh for a significant period of time.

At this point in the narrative, in contrast to the fairly long and circumstantial account of the Philistine epidemic, comes very brief mention of the sudden death of " 70 men, 50,000 men " of Israel at Beth-Shemesh. Their offense was that they " had looked at the Ark of the Lord." [3]

The biblical text is obviously defective in the statistical phrase used.

[2] Some authors freely interpret the phrase " the mice which destroyed the land " (I Sam. VI, 5) to mean that a severe epizootic occurred among rodents, killing many of them (1). Though the Septuagint refers to the plague of rodents more fully than does the Bible, it fails to resolve this point. The phrase in question has even been assumed to indicate the recognition by the ancients of the causal relationship between swarms of rodents and the spread of disease among human beings (8).

[3] " And He smote of the men of Beth-Shemesh because they had gazed upon the Ark of the Lord, even He smote of the people seventy men, fifty thousand men: and the people mourned because the Lord had smitten the people with a great slaughter." I Sam. VI, 19. According to the Septuagint: " And the sons of Jochoniah rejoiced not with the men of Beth-Shemesh when they saw the Ark of the Lord; and He smote among them seventy men."

The grammar is imperfect (the copulative *vav* is missing between the "70 men" and the "50,000 men") and the rhetorical form is atypical: the "70 men" precedes the "50,000 men," and the word "men" is repeated (17). For as small a town as Beth-Shemesh must have been, the death of only 70 men would have been a severe blow. According to some commentators, the additional 50,000 men may constitute a textual gloss (16-18). The medieval Jewish exegete, Rashi (31), in accordance with one of the Talmudical explanations (32), interprets this difficult passage as meaning that 70 men died, whose worth was that of 50,000, which would imply that among the victims were the elders and important men of the community.

As has been pointed out, there is extensive agreement on the identification of the Philistine epidemic as bubonic plague. Biblical commentators and medical authorities, however, have directed comparatively little attention to the subsequent epidemic that occurred among the Israelites at Beth-Shemesh. While this epidemic was obviously related in some way to the Philistine epidemic, the two differ in time, place, and symptomatology, and should not be confused with each other. Simpson (3) failing to recognize the differences between the two epidemics, states that plague occurred in the land of the Philistines and that the "inhabitants of the cities of Ashdod, Gath and Ekron, as well as those of Beth-Shemesh, were smitten with 'emerods'." However, it must be pointed out that there is no mention in the biblical text of buboes (emerods) occurring among the Israelites in Beth-Shemesh. Strong (12) also confuses the two epidemics. While identifying the Philistine epidemic as the first recorded outbreak of bubonic plague, to indicate its severity he gives the mortality statistics of the Israelites at Beth-Shemesh.

The other authors who discuss the Israelite epidemic recognize that it was distinct from the Philistine epidemic. Thus, Preuss (5) speculates on the possibility of a connection between the two epidemics, but comes to no conclusion. Allen (4) suggests that the Philistine disease spread to the Israelites because "there was no sanitary precaution in the Levitical code to prevent spreading of the disease." Crawford (6) considers the two epidemics to have been separate outbreaks of the same disease: "when the plague of Ashdod falls on the Israelites, God's chosen people, it is perplexing, for knowledge of contagion and communicability is as yet unborn." Holmes (9) also believes that there was a spread of bubonic plague from Philistines to Israelites.

An earlier study, that of Tidswell and Dick of 1899 (1) is by far the

most complete and lucid analysis of the biblical plague story. The authors, like Allen and Crawfurd after them, ascribe the Israelite epidemic to the spread of bubonic plague from the Philistines, although they note that no symptoms of the Israelite epidemic are given in the text. In their account they refer to the details of Levitical prophylaxis of which Allen (4) and Crawfurd (6) are apparently unaware. " That the disease, though introduced, did not spread among the Israelites is not surprising. The Beth-Shemeshites practiced, albeit inadvertently, the best possible means of disinfection when they burned the cart and the oxen.[4] Their dread of pollution from a corpse[5] would render them most careful in dealing with bodies, clothing, etc., of those who died. The Ark itself was put into seclusion (isolation) for 20 years at least, and no doubt was most circumspectly handled by the men conveying it. . . ."

There are, however, definite objections to the unquestioning assumption that the Israelite epidemic was bubonic plague. Attention is called to the following points:

1) Although the Philistine epidemic occurred in a hostile foreign land, the intimate details of this epidemic, such as the buboes, the swarms of rodents, and the milder nature of the disease at Ekron, were known to the Israelites and noted in the Bible (33). Hence, it is reasonable to believe that the occurrence of buboes or swarms of rodents among the Israelites would certainly not have escaped notice. This omission from the biblical text is presumptive evidence that buboes and the presence of rodents were not characteristic of the disease among the Israelites.

It cannot be assumed that original references to buboes and rodents among the Israelites might have been deleted from the record lest the chosen people be revealed to have suffered from the same loathsome disease as the idolatrous Philistines. The Bible is notably lacking in reticence when dealing with the faults and sins of the Israelites and their heroes. Furthermore, there is a precedent for Israel's suffering from the same diseases as its enemies, and from buboes specifically. It occurs in Deut. XXVIII, 27, and is the only other place in the Bible where the word for buboes, *apholim*, appears: " and the Lord will smite you with the boil of Egypt, and with the bubo, and with the scab and with the itch, whereof thou canst not be healed."

[4] The cart was drawn by milk cows, recently calved, not oxen, a point of significance from the supernatural aspect of the biblical account. According to Rashi, only divine compulsion would have caused the cows to leave their calves and carry the Ark back to the Israelites.

[5] Cf. the " Levitical Code," Lev. XXI, 1 and XXII, 4. Also Numbers XIX, 11-16.

2) The mortality among the Israelites was apparently much higher than that among the Philistines of Ekron from whom the disease might be assumed to have spread. At Ekron recoveries were sufficiently numerous to be recorded in the text (33), but no mention is made of recoveries among the Israelites.

3) From the curt description of the Israelite epidemic it may be inferred that it was of short duration and that the victims died rapidly without noteworthy symptoms.

From consideration of these points we may assume that the episode at Beth-Shemesh was not bubonic plague. The following facts support the author's opinion that the outbreak was one of pneumonic plague.

While the mortality of bubonic plague varies from 60-90 per cent (untreated), pneumonic plague is almost invariably fatal, so that recovery casts doubt on the diagnosis. Although bubonic plague lasts 4-7 days, the duration of pneumonic plague is only 1-3 days, death frequently occurring as early as 16 hours after the onset of symptoms.

Hemoptysis is the only symptom of any degree of specificity in pneumonic plague, but it is neither profuse, nor uniformly present. In describing an epidemic, Heggs (34) listed five symptom complexes. One of these included only fever, dyspnea, and chest pain, and did not include hemoptysis. Gorelik (35) found that hemoptysis was an infrequent and minor symptom in the many cases of pneumonic plague that he observed in Egypt and Syria. Inguinal buboes do not occur in pneumonic plague and cervical buboes occur but rarely.

Primary pneumonic plague arises from contact with patients with the septicemic type of the disease, or those with the bubonic type who develop secondary plague pneumonia. The pneumonic variety is either transmitted directly from man to man by droplet infection or indirectly by fomites. In either case there is no intervention of rodents and their fleas as vectors. Thus, like the disease at Beth-Shemesh, pneumonic plague is not associated with rodents or buboes, does not have very distinctive symptoms, and all patients affected die rapidly.

Cases of pneumonic plague usually occur as scattered cases or as groups of cases in the midst of larger epidemics of bubonic plague. At Beth-Shemesh, however, there appears to have been an epidemic of only the pneumonic type of plague. Search of the medical literature has revealed well-documented accounts of outbreaks of pure pneumonic plague which are strikingly similar in certain respects to the epidemic at Beth-Shemesh.

As described below, such outbreaks arose from bubonic plague in one locality after transient contact was effected between its inhabitants and those of a second locality.

In Phüoc-Hung, Siam (36), a villager returned from a neighboring town where there had been a number of bubonic plague deaths. Five hours after his return he became ill, and died promptly. Seventy-five deaths from pneumonic plague followed in the village, but no cases of the bubonic type were found. There had been no recent cases of plague in the village. Few rats were seen that year, and no epizootic had occurred among them.

In Iraq (34) a Bedouin returned to his encampment from a visit to nearby Baghdad where there had been sporadic cases of bubonc plague. Two days later he became ill and developed an axillary bubo. He died 7 days thereafter. At intervals, his father, mother, and sister died, but without developing buboes. Twelve out of the 40 people in this encampment died of pneumonic plague. A total of 90 cases, all of the pneumonic type, resulted from spread of the epidemic to other camps. No rats were seen, dead or alive, in the region.

At Munda, in India (37), a man returned from a village that was infected with bubonic plague. He became ill and died one day later. Within 12 days, 15 members of his family died of pneumonic plague. No rats were seen during the epidemic.

In Oakland, California, in 1919 (38), a man returned from a hunting expedition with the carcass of a squirrel. He became ill, showed signs of lobar consolidation, and developed an axillary bubo. He died two days later. In rapid succession, 12 primary and secondary contacts contracted pneumonic plague and died within a period of 2-5 days, save one patient who recovered. Some of the contacts were only fleeting. One secondary case lived in the same house as the first victim, but apparently did not even enter the sickroom.

In reconstructing the epidemology of the plague described in the Bible, it may be assumed, on the basis of the above parallels, that a member of the Philistine delegation might have become ill while in Beth-Shemesh. In view of the peaceful nature of the mission, the eastern code of hospitality would almost certainly have been applied, and the sick man brought into close contact with some of the Israelites. Other possible means of introducing the infection would include cases of "walking plague," or even healthy individuals, since it has been observed that the latter can occasionally carry pneumonic plague without themselves becoming ill (3).

The cart which carried the Ark, and the golden images might have acted as fomites. Finally, Gotschlich (39) has described two convalescents from secondary plague pneumonia, and one apparently from primary pneumonic plague, who carried virulent plague bacilli in their sputa for periods of 19-42 days after recovery. A member of the Philistine delegation which met with the elders of Beth-Shemesh and remained in contact until after the sacrifice of the cows might well have been such a carrier.

At the risk of over-literal reading of the biblical text, one might assume that one of the lords of the Philistines was a convalescent carrier of plague bacilli. According to the text, one or more of the five lords was stricken with the plague,[6] yet all five lords were members of the group which later returned the Ark and came into contact with the elders of Beth-Shemesh.[7]

In any one of these ways, the microorganisms causing bubonic plague among the Philistines could have been introduced among the Israelites at Beth-Shemesh, resulting in a short, sharp outbreak of pure pneumonic plague.

Summary and Conclusions

Evidence has been cited that the epidemic among the Israelites at Beth-Shemesh, described in I Samuel VI, was in all likelihood pneumonic plague. This evidence has been drawn from statements in the biblical text, from signficant omissions from the text, and from a number of well documented accounts of modern epidemics of pneumonic plague that closely parallel the episode described in the Bible. If the author's interpretation of this evidence is valid, the first record of an epidemic of pneumonic plague is to be found in the Bible.

REFERENCES

1. Tidswell, F. and Dick, J. A.: Bubonic Plague in 1141 B. C. *Australasian Med. Gaz.* 18: 413, 1899.
2. Ebstein, W.: *Die Medizin im Alten Testament.* Stuttgart, Enke, 1900.
3. Simpson, W. J. R.: *A Treatise on Plague.* Cambridge, University Press, 1905.
4. Allen, D. B.: Diseases Mentioned in the Bible. *Dietet. and Hyg. Gaz.* 24: 285, 1908.
5. Preuss, J.: *Biblisch-Talmudische Medizin.* Berlin, S. Karger, 1911.

[6] "For one plague was on you all, and on your lords." I Sam. VI, 4.

[7] "And the lords of the Philistines went . . . unto the border of Beth-Shemesh." I Sam. VI, 12. "And . . . the five lords . . . returned to Ekron the same day." I Sam. VI, 16.

6. Crawfurd, R. H. P.: *Plague and Pestilence in Literature and Art.* Oxford, Clarendon Press, 1914.
7. Harris, D. F.: Emerods, Mice, and the Plague of I Samuel, Chapter VI. *Ann. Med. Hist.* 3: 359, 1921.
8. Lien-Teh, W.: *A Treatise on Pneumonic Plague.* Geneva, League of Nations Publications, No. 3, 1926.
9. Holmes, W. H.: *Bacillary and Rickettsial Infections, Acute and Chronic.* New York, Macmillan, 1940.
10. Castiglioni, A.: *A History of Medicine.* New York, Alfred A. Knopf, 1941.
11. Wilson, G. S., and Miles, A. A.: *Topley and Wilson's Principles of Bacteriology and Immunity,* 3rd ed. Baltimore, Williams and Wilkins Co., 1946.
12. Strong, R. P.: *Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases,* 7th ed. Philadelphia, The Blakiston Co., 1944.
13. Annotation. *Lancet,* 1: 68, 1949.
14. MacArthur, W. P.: The Occurrence of the Rat in Early Europe, The Plague of the Philistines (1 Sam., 5, 6). *Trans. Roy. Soc. Trop. Med. and Hyg.* 46: 209, 1952.
15. MacArthur, W. P.: "Plague of the Philistines." *Trans. Roy. Soc. Trop. Med. and Hyg.* 46: 464, 1952.
16. Smith, H. P.: The Books of Samuel, in *International Critical Commentary.* New York, Charles Scribner & Sons, 1899.
17. Kirkpatrick, A. F.: First Book of Samuel, in *Cambridge Bible for Schools and Colleges.* Cambridge, University Press, 1911.
18. Driver, S. R.: *Notes on the Hebrew Text of the Books of Samuel.* Oxford, The Clarendon Press, 1890.
19. Kennedy, A. R. S.: Samuel, Introduction, Revised Version with Notes, Index and Maps, *The Century Bible.* London, Thos, Nelson & Sons, Ltd. (not dated).
20. Neustätter, O.: The "Emerods" of the Book of Samuel. *J. A. M. A.* 114: 1106, 1940.
21. Neustätter, O.: Where did the Identification of the Philistine Plague (I Samuel, 5 and 6) as Bubonic Plague Originate? *Bull Hist. Med.* 11: 36, 1942.
22. Neustätter, O.: A Forgotten Monograph on *Apholim* Tainted with a Suspicion of Plagiarism. *Bull. Hist. Med.* 13: 278, 1943.
23. Driver, G. R.: The Plague of the Philistines. (I Samuel V, 6-VI, 16). *J. Roy. Asiatic Soc. Great Britain & Ireland,* p. 50, 1950.
24. Shrewsbury, J. F. D.: The Plague of the Philistines. *J. Hyg.* 47: 244, 1949.
25. Pollitzer, R.: Plague Studies, I. *Bull. World Health Org.* 4: 475, 1951.
26. Josephus, F.: *The Antiquities of the Jews* VI, 1, 3.
27. Grossman, R. and Sachs, T.: *Compendious Hebrew-English Dictionary,* Comprising a Complete Vocabulary of Biblical, Mishnaic, Medieval, and Modern Hebrew. Tel Aviv, Dvir, 1938.
28. I Sam. VI, 19.
29. Beecher, W. J.: *The Dated Events of the Old Testament.* Philadelphia, The Sunday School Times Co., 1907.

30. I Sam. VI, 16.
31. Rashi, *ad loc.*
32. Babylonian Talmud, Sotah, 35b.
33. I Sam. V, 12.
34. Heggs, T. B.: Pneumonic Plague in Iraq. *Trans. Roy. Soc. Trop. Med. and Hyg.* 18: 45, 1924.
35. Gorelik, A. N.: Personal communication.
36. Botreau-Roussel, J. M.: Rapport sur l'épidémie de peste pulmonaire de Phüoc-Hung (province de Chaudoc) du 14 avril au 16 juin, 1911. *Ann. Hyg. et Med. Colon.* 14: 714, 1911.
37. Smith, S. B.: Report on Plague and Inoculation Operations, Amritsar District, 1st October 1902 to 20th June 1903. *Ind. Med. Gaz.* 39: 209, 1904.
38. Kellogg, W. H.: An Epidemic of Pneumonic Plague. *Am. J. Pub. Health* 10: 599, 1920.
39. Gotschlich, E.: Ueber wochenlange Fortexistenz lebender virulenter Pestbacillen im Sputum geheilter Fälle von Pestpneumonie. *Z. Hgy. u. Infectionskrank.* 32: 402, 1899.