Kill or cure? The osteological evidence of the mercury treatment of syphilis in 17th- to 19th-century London

Fiona Tucker

Introduction

Syphilis is one of the most important diseases in the history of London. Like the Black Death, tuberculosis and cholera, it affected a huge number of people, but unlike these diseases, which only became epidemic a few times in the city's history, syphilis seems to have been a constant, insidious presence from at least the early 16th into the 20th century. Descriptions of the affliction fill the pages of medical treatises, memoirs, journals, novels and plays. Pepys wrote in his diary in March 1664 that his brother fell ill of the pox, and lamented that "if he lives, he will not be able to show his head – which will be a very great shame to me."[1]

The stigma surrounding the disease appears to have constituted a problem for surgeons – in his *Treatises* Wiseman, a prominent 17th-century London surgeon, described how, after diagnosing a patient with the dreaded disease, he found himself dismissed in favour of another surgeon.[2] Though many of these sources portray the disease in a humorous light, as just another part of London life, syphilis was a serious health problem in this period, and doctors were largely unable to cure it.

Mercury, 'a medicine which has become celebrated in the history of syphilis', was the treatment of choice from the late 15th century into the early 20th century. The three main methods of application were fumigation, in which the unfortunate sufferer was placed in a tent in an overheated room and cinnabar (mercury oxide) burnt on a stove and breathed in until he (or she) could take no more;[3] inunction or rubbing into the skin of mercury or a mercurial compound; and ingestion of the metal in pill or liquid form, which became increasingly popular in the 18th and 19th centuries.[4] Painful and debilitating, the mercury 'cure' was often accused of being worse than the disease. Large doses of mercury can cause acute and occasionally fatal poisoning, and even smaller amounts of the metal, if absorbed over a long period, can cause chronic poisoning, with symptoms such as salivation, inflammation and ulceration of the mouth and throat, erethrism (a condition of nervousness, irritability, change of temperament and fits of temper), tremor, fatigue, weight loss, gastrointestinal disturbances and kidney problems.[5]

Just how effective the remedy was is still a matter of debate. Mercury is spirilocidal, and may have occasionally been able to destroy the bacteria in lesions,[6] and due to its anti-mitotic and anti-inflammatory properties may have been able to clear up the ulcers and sores which were the most obvious signs of syphilis, as many writers proclaimed.[7] However, the natural spontaneous disappearance of syphilitic lesions may have confused early doctors.

Palaeopathology has taken an increasingly large role in the debates over syphilis in the last century, due to the confusing and often contradictory nature of the surviving documentary evidence. This is particularly the case in the debate over the origin of syphilis, which has received a great deal of attention by both historians and osteologists. However, palaeopathology could also be a useful tool in examining the changing nature of the disease, and of its cure, over the following centuries. The signs of syphilis in dry bone have been described at length by several authors,[8] and most characteristically involve a pattern of scooped-out lesions surrounded by reactive new bone, particularly dramatic when seen on the skull (Fig. 1). However, the affects of mercury treatment have received curiously little attention. Although chronic mercury poisoning very rarely seems to cause pathological lesions in the bones, levels of this metal in human remains are believed to stay relatively constant after death, and should still be there to be studied by modern researchers.

In this study, macroscopic signs of mercury poisoning were looked for and bone levels of mercury were measured in the skeletons of individuals who are believed to have been afflicted with syphilis in 17th- to 19th-century London. The way in which mercury levels corresponded with skeletal lesions, age at death and tooth condition were examined to try to provide the answers to some important questions: do high levels of mercury appear in the bones of 17th- to 19th-

century syphilis sufferers, suggesting they received mercury treatment? If so, do these high levels correspond with a particular age or sex group, or any obvious skeletal or dental changes, and in particular with an alteration of the 'typical' osteological manifestations of syphilis? This study was designed to shed some light on how extensive, effective or destructive the mercury treatment of syphilis was in London in the 17th to 19th centuries.

Materials and method

Twelve skeletons from the Museum of London collections, excavated from three London sites dating from the 17th, 18th and 19th centuries – New London Bridge (NLB91), Farringdon Street (FAO90) and Redcross Way (REW92) – were included in this study on the basis of skeletal lesions typical of tertiary syphilis. Five of the skeletons included had cranial changes, representing various stages in the *caries sicca* sequence. Two further skeletons displayed gummatous lesions. Three skeletons were included on the basis of convincing nongummatous changes. Finally, two neonatal skeletons displaying metaphyseal changes and diffuse periostitis were included as probable cases of early congenital syphilis. Estimated sex and age and tooth condition were recorded for each skeleton, as well as pathological lesions.

Three Anglo-Saxon skeletons from the Cherry Hinton site, Cambridge, were used as controls. Mercury appears to have been rarely used in the Anglo-Saxon period, and no case of syphilis from this time is known.

Inductively coupled plasma mass spectrometry (ICP-MS) was used to measure the levels of mercury remaining in the bones of the skeletons. This study is one of the first to involve the measurement of mercury levels in archaeological bone, and the very first to use ICP-MS to do so. The technique was selected due to its potential to detect elements down to one part per billion – the average level of mercury in modern dry bone is thought to be around 0.5 ppm (parts per million),[9] and a low detection limit was therefore vital. Bone fragments from the ends of ribs were tested, due to the frequent occurrence, easy removal and relative disposability of these fragments and to the fact that mercury in bone is likely to be found in heavier concentrations in cancellous bone, and tends to pool in the ends of the long bones and ribs.[10]

Results

The results for the 17th- to 19th-century skeletons are shown in Table 1. The Anglo-Saxons from Cherry Hinton all produced readings of between 1.5 and 2 ppm mercury.

The results for New London Bridge were the most convincing and dramatic. Of the seven individuals from this site, three produced very low mercury readings – less than 2.5 ppm, comparable to all the Anglo-Saxon controls. The other four, however, retained very large amounts of mercury, ranging between 14 and 18 ppm – much higher than is found in normal bone. It therefore seems reasonable to suggest that these four individuals had absorbed more mercury than the others during life, and the most likely source, given their pathology, is here argued to be medical treatment for syphilis. The proximity of St Thomas's Hospital, which was offering free mercurial salivation therapy in this period, is a useful piece of corroborating evidence.[11]

The fact that only two cases were included from Farringdon Street made these results harder to assess. There is clearly a difference between the 1.5 ppm mercury reading of Skeleton 1932 (again apparently within normal limits) and the nearly 5 ppm of Skeleton 1563, which does appear to have been artificially increased during life, although not

Fig. 1: skull of Skeleton 99

to the extent of the individuals at New London Bridge. It is certainly arguable that this increase may be due to mercury treatment, although the size of the difference is not totally convincing.

Redcross Way proved the most difficult of all to assess. All three of the skeletons from this site registered mercury levels clearly above those of the Anglo-Saxon controls and modern levels, ranging between 6 and 7.5 ppm. The small range of variation in the mercury levels of the skeletons from this cemetery means that burial soil cannot be absolutely ruled out as the source, despite the rarity

Table 1

Skeleton	Completeness /Preservation	Sex	Age	Dental Health	Location of skeletal lesions	Type of lesions	mercury level (ppm)
NLB91 15	67% average	?	50+	Good: no teeth lost a.m., no caries, alveolar thinning, wear	Cranium (frontal, parietal), mandible, sternum, clavicles, some long bones	P.n.b and small cavities on cranium, cavities in mandible, p.n.b on post-cranium	1.38
NLB91 66	77% average	female	30-40	Average: 2/3 teeth lost a.m.	Right humerus and ulna, left ulna, most leg bones	Gross periosteal new bone, possible gummatous cavities	2.43
NLB91 79	81% good	female?	30-40	Average: 3 teeth lost a.m., caries in 3 teeth, one cavirty in alveolus	Cranium (frontal and parietals), right clavicle, tibiae?	Clustered pits and focal cavitation on cranium, p.n.b on post-cranium	16.69
NLB91 192	22% poor	female?	40-50	No teeth present	Left ulna and tibia, right tibia and fibula	P.n.b and g. cavities	17.24
NLB91 208	34% poor	juvenile?	14-16	No teeth present	All long bones present	P.n.b, possibly g. cavities	9.17
NLB91 218	69% average	male?	20-30	Poor: 2 teeth lost a.m., caries in 7 teeth, alveolar disease and cavities	Cranium (frontal and left parietal), sternum and humerus	Clustered pits on cranium, p.n.b on post-cranium	14.87
NLB91 567	34% average	male?	40-50	No teeth present	Both femora and tibiae, left fibula	Gross p.n.b	1.53
FAO90 1563	90% good	male	30-40	Poor: 6 teeth lost a.m., caries in 5 teeth, alveolar recession	Cranium (esp. frontal and parietals) all long bones, clavicles, sternum, ribs	Clustered pits and p.n.b on cranium, p.n.b and g. cavities on post-cranium	4.91
FAO90 1932	87% good	male?	30-40	Good: no teeth lost a.m., no caries, healthy alveolus, *but* worn m l's	Cranium (frontal and parietals), most long bones, clavicle, rib, spine?	Focal and serpiginous cavitation with little repair on cranium, p.n.b and g. cavities on post-cranium	1.54
REW92 82	58% good	juvenile?	0	Only teeth buds present	Cranium (frontal), left clavicle and humerus, all leg bones	Porous p.n.b with cavities	6.03
REW92 99	87% good	female	40-50	Poor: 6 teeth lost a.m., caries in 6 teeth, alveolar recession, hypoplasia	Cranium (frontal and parietals), clavicles, scapulae, some arm bones, all leg bones	Entire caries sicca sequence on cranium, p.n.b on post-cranium	7.33
REW92 103	50% good	juvenile?	8 mo.	No teeth present	All long bones, ribs, clavicle	P.n.b and saw-toothed metaphyses (osteochronditis)	7.15

of mercury in soil. However, it is arguably more likely that these individuals (or the mothers of these individuals, in the case of the neonates) really did absorb unusual quantities of mercury during their lifetimes, either from syphilis treatment or another source.

Discussion

Both male and female skeletons displayed raised levels of the metal in their bones. Historical evidence certainly suggests that although there was no theoretical objection to women receiving mercury treatment, they may have had more trouble obtaining it due to the lower number of beds provided for female venereal patients in the capital throughout the period under study.[12] No evidence was found of this in the study, with two women from New London Bridge, and possibly also women from Redcross Way, apparently obtaining treatment – in fact the women from New London Bridge registered the highest mercury levels in the study.

There was also no very striking relationship between mercury levels and age, although the two individuals who died youngest (apart from the neonatal skeletons) both had raised levels of the metal. This fact does not look promising for the mercury treatment – those who apparently received it were certainly not living any longer than those who did not.

Incidentally, it is difficult to assess the average age at death of the syphilis sufferers in this study, as it seems that the frequent problem of under-ageing older skeletons may have occurred; only one of the individuals in this study, by traditional ageing estimation, seems to have lived past the age of 50. Bills of Mortality for the 18th and 19th centuries suggest that 20–30% of the population of London surpassed this age.[13] If the age estimations in this study are taken as correct, then tertiary syphilis appears to have had a serious impact on life expectancy in this period.

There did appear to be a relationship between mercury levels and dental degeneration, particularly in terms of caries, suggesting that the metal was indeed weakening the teeth. None of the skeletons with a noticeably raised level of mercury had good teeth, and all those with teeth in a very poor condition also had high levels of the metal. This trend was particularly noticeable at New London Bridge; the skeleton with the healthiest dentition, NLB 15, contained the lowest mercury levels and the individual with the worst teeth, NLB 218, produced a reading of 14.87 ppm mercury.

Of all the skeletons in this study, the only one in which syphilis might reasonably be implicated as a cause of death (the disease is not usually fatal) is Skeleton 1932 from Farringdon Street, whose lesions appear to have been frighteningly active at the time of death (Fig. 2). It is interesting that this individual does not seem to have received enough mercury treatment during their life to leave a skeletal trace. The three skeletons with the most extreme new bone growth were skeletons NLB91 66 and 567, and FAO90 1932, and again all of these had low levels of mercury. This suggests that mercury treatment may have had some effect on curbing bone involvement in syphilis.

No unusual skeletal pathology that could have been caused by mercury poisoning alone was noted in this study. Necrosis of the jaw, frequently suggested as a possible skeletal lesion caused by mercury poisoning,[14] was not noted in the skeletons with high mercury levels. These results seem to support the opinion of most palaeopathologists, that mercury poisoning leaves no distinguishable trace on dry bone.[15]

Conclusion

The main aim of this study was to discover whether it is possible to detect a specific form of medical treatment, mercury therapy, in the bones of syphilitics from 17th- to 19th-century London. The answer to this question appears to be yes: in the 17th-century group especially, trace element analysis revealed unusual, artificially increased levels of mercury in some skeletons showing evidence of syphilis.

Not all skeletons registered high levels; many were comparable to the Anglo-Saxon controls, and this level of mercury, similar to modern levels, can perhaps be considered as the normal content of the dry bone of an individual who was not overly exposed to this metal during his or her lifetime. It would be surprising if all syphilitics among the poor who are represented in this study submitted voluntarily to a treatment as frightening and uncomfortable as mercurial salivation. However, this study suggests that such treatment was available to and made use of by at least some members of this group.

This study does support the idea that mercury treatment was often destructive – some of those with higher levels of mercury in their bones seem to have died younger, and usually in worse dental health than those with lower levels, although the small size of this sample makes generalization difficult. However, it is also worth pointing out that the only individual who skeletal evidence suggests may have died of syphilis (FAO90 1932) does not seem to have received mercury treatment – the absence of which in this case does not seem to have helped the situation. Also, no destructive bone lesions attributable to mercury were discovered in this study, and the syphilitic lesions of those who received treatment were less severe than those of the individuals who had absorbed very little of the metal. To dismiss mercury treatment as 'a colossal hoax'[16] is therefore perhaps too harsh. It was, after all, the only option tried to

treat this terrible disease that seemed to have any real effect, and whether to withhold treatment is just as irresponsible as to prescribe a dangerous one is a difficult question.

It is worth noting that all the cases of syphilis included in this study are from apparently low socio-economic class cemeteries. This might seem to suggest that these are the cemeteries, and hence the ranks of society, that suffered most from syphilis. However, several cases of syphilis have been reported from more wealthy London cemeteries, such as Marylebone[17] and Spitalfields.[18] Documentary sources certainly do not give an impression of syphilis as a disease of the poor; if anything, the number of high-status victims, presumably relatively spared from other diseases such as tuberculosis, is remarked upon.[19] Chastity, not wealth, was the way to avoid the pox, and the rich of 17th- to 19th-century London seem to have been just as inept at this as the poor.

The probable low status of the individuals in this study might be expected to have had some influence on the level of treatment they received – Petrie has argued in reference to mercury that 'continued treatment and application of a chemical which was not readily available put it out of the reach of all the lower parts of society'.[20] However, Siena points out that, contrary to past assumption that mercury treatment would be priced out of the range of the poor, free or cheap public treatment for the pox was available throughout this period. During the 17th century, two London hospitals in particular, St Bartholomew's and St Thomas's, provided free in-patient care to venereal patients.[21] The fact that some individuals in this study do seem to have obtained mercury treatment is an interesting piece of evidence about the ubiquity of mercury treatment at this time in London.

Fig. 2: skull of Skeleton 1932

Acknowledgements

I would like to thank Bill White and the staff of the Centre for Human Bioarchaeology at the Museum of London for allowing me to use their collections for this project, and especially for believing it important enough to justify destructive testing. I must also thank the technicians at UCL Institute of Archaeology, who allowed me to use the ICP-MS machine, and who gave up their time to help run the samples through with the machine growing increasingly temperamental, and Dr Tony Waldron for the inspiration for this project and all his help along the way.

1. A. Wear 'Medicine in Early Modern Europe, 1500-1700', in L. Conrad, V. Nutton, R. Porter and A. Wear (eds), *The Western Medical Tradition, 800 BC to AD 1800* (2000) 215–362, 262.

2. *Ibid*, 263.

3. C. Quetel *The History of Syphilis*, trans. J. Braddock and B. Pike (1990) 60.

4. *Ibid*, 84–92.

5. L. Bidstrup *Toxicity of Mercury and its Compounds* (1964) 9, 29–45.

6. J.G. O'Shea 'Two minutes with Venus, two years with mercury – mercury as an antisyphilitic chemotherapeutic agent' *J Royal Soc Medicine* **83** (1990) 392–395.

7. J. Fabricius *Syphilis in Shakespeare's England* (1994); L.J. Goldwater *Mercury: A History of Quicksilver* (1972) 37.

8. See particularly D. Ortner and W. Putschar *Identification of Pathological Conditions in Human Skeletal Remains* (1985)180–197 and A.C. Aufderheide and C. Rodriguez Martin *The Cambridge Encyclopaedia of Human Paleopathology* (1998) 158–161.

9. J. Emsley *Nature's Building Blocks: An A-Z Guide to the Elements* (2001) 254.

10. T. Waldron, *pers. comm.* (2006).

11. K.P. Siena *Venereal Disease, Hospitals and the Urban Poor* (2004) 2.

12. *Ibid*, 111–2.

13. C. Roberts and M. Cox *Health and Disease in Britain, from Prehistory to the Present Day* (2003) 304.

14. C.J. Hackett 'Diagnostic criteria of syphilis, yaws, treponarid (treponematoses) and of some other diseases in dry bones' *Sitzungsberichte der HeidelBerger Akademie der Wissenschaffen Mathematisch-Naturwissen Schaftliche Klasse*, Jahrgang 1976, **4** Abhandlung (1976) 351–470, 357.

15. T. Waldron, *pers. comm.* (2006).

16. Goldwater, *op cit* fn 7, 226.

17. White, *pers. comm.* (2006).

18. T. Molleson and M. Cox *The Spitalfields Project Vol. II, The Anthropology.* (1993).

19. *Op cit* fn 11, 4.

20. H. Petrie *The French Pox* (1999) 10.

21. *Op cit* fn 11 1–3.