

# Is Lead Exposure Still The Best Explanation For Beethoven's Deafness?

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## Abstract

**Objectives:** An article in Current Biology in March 2023 suggested that lead poisoning does not apply to Beethoven because the Hiller lock was found to be inauthentic. In addition, bone samples that contained high levels of lead have also been discovered to be inauthentic. This communication is a response to this as well as other challenges to the article in The Laryngoscope in 2013 about lead and the hearing loss of Ludwig van Beethoven.

**Methods:** An in-depth review of these articles was accomplished to assess whether lead poisoning is still a viable theory for Beethoven's hearing loss.

**Results:** A substantial review of over 2000 cases in 2016 showed uniformly abnormal auditory brainstem responses with chronic lead poisoning that correlate well with the shrunken cochlear nerves found at Beethoven's autopsy. An article published in 2017 postulated a new reason for Paget's Disease, but has serious deficiencies. The current case of lead poisoning in The Laryngoscope in 2020 supports lead as a cause significant hearing loss. In 2022 a suggestion of congenital syphilis was found to lack substantial evidence.

Although the article in Current Biology in March 2023 suggested that lead poisoning does not apply to Beethoven because the Hiller lock was found to be inauthentic, no authentic samples have ever been tested for lead. Therefore, this is a premature opinion.

**Conclusion:** Future directions listed in the Current Biology article include testing for exposure to environmental causes of disease. We will therefore wait with great anticipation to the analyses of authentic hair samples. It may not be surprising that these will also show high levels of lead. If they do not, all of the suggested reasons for Beethoven's hearing loss will have major problems, and we may never fulfill his wish to discover the etiology of his loss.

## Introduction

One of the most interesting cases of all time is that of Beethoven's hearing loss and other medical problems. There are many opinions regarding his hearing loss. In 2013 an

article was published in the Laryngoscope suggesting that lead poisoning was the best explanation for his hearing loss [1]. Since the time of that publication there have been articles that have challenged and articles that have supported this

etiology.

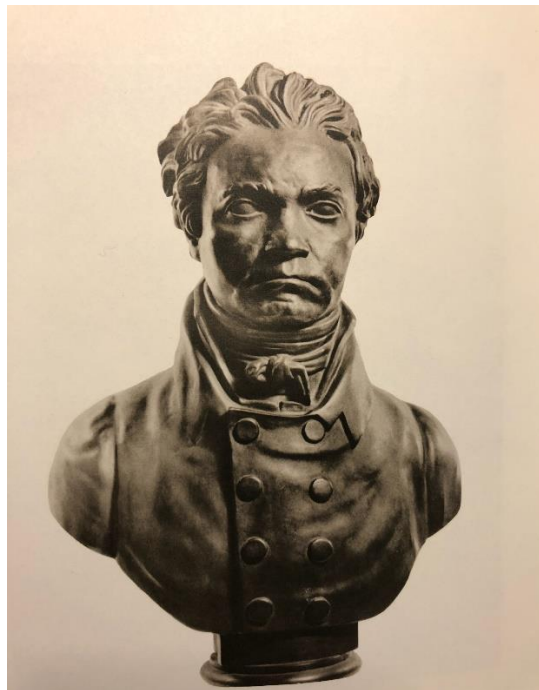
## Materials And Methods

A response to these articles was undertaken by means of review and comment.

## Results And Discussion

In 2016 a review done by Castellanos of over two thousand cases of hearing loss due to chronic lead poisoning showed uniformly abnormal auditory brainstem responses [2]. These indicate that the site of hearing loss is the cochlear nerve. This is consistent with axonal degeneration caused by lead poisoning, and corresponds to the shrunken cochlear nerves found at Beethoven's autopsy [3].

An article in 2017 written by Oiseth, a pathologist, suggested that Paget's Disease or osteitis deformans was the cause of Beethoven's deafness because of the excessive thickness of his skull [4]. See **figure I**. An examination of several large pieces of Beethoven's skull bone had previously been done and found to lack evidence of Paget's Disease[5]. Recent examination of these bone fragments however, have found that they are not authentic because the authors reported them erroneously to be parietal bone, whereas they were found to be frontal bone. Beethoven's frontal bone had a bone saw cut across it done at the time of his autopsy which was lacking in these samples [6].



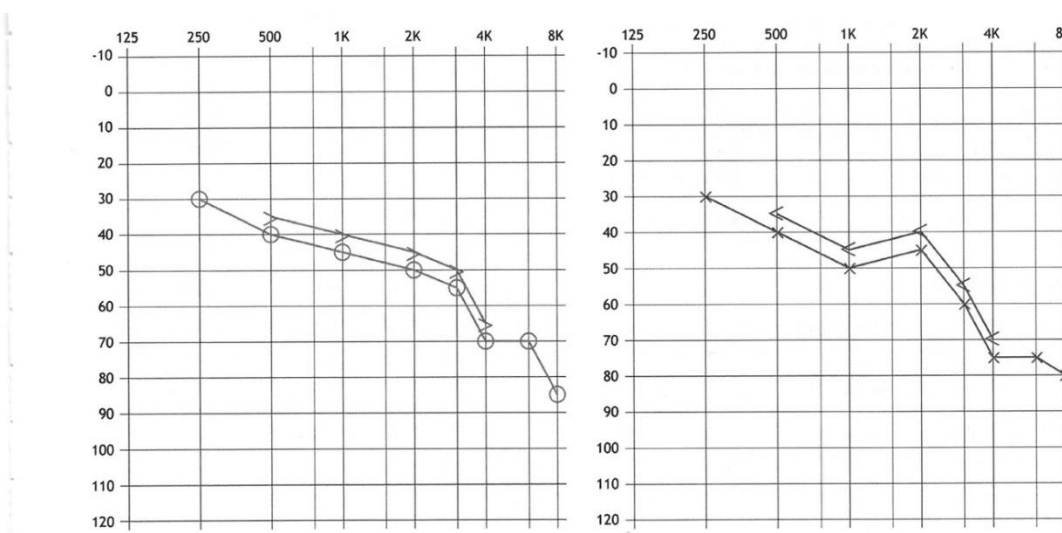
**Figure 1.** Beethoven's prominent and irregular forehead

Gross examination of Beethoven's middle ears was done at the time of his autopsy and found to be normal. Although Paget's Disease can cause sensorineural hearing loss [7], most cases have a mixed loss because of middle ear involvement such as fixation of the stapes, microfractures, and fissures of the otic capsule. Chronic renal disease found at his autopsy can also cause secondary hyperparathyroidism and resultant bone thickness. It seems therefore that Paget's Disease is not the best explanation for Beethoven's deafness. In 2020 Brotto published a remarkable case in the *Laryngoscope* of lead poisoning in a 64 -year-old female [8].

Her audiogram showed a high frequency hearing loss like Beethoven had during the onset of his hearing loss. See **figure 2**. However, she had normal auditory brain stem responses, in contrast to all other reported cases of chronic lead poisoning, and high levels of lead in her blood in contrast to lower levels reported in chronic exposure cases. She also had asthenia, or generalized weakness. Asthenia implies muscle weakness. An electromyogram was not reported in this communication. Had it been done, It probably would be abnormal and show extensor weakness suggestive of classic or subacute lead poisoning rather than chronic lead poisoning. The striking

feature of this case is that it appears to be the first case of classic lead poisoning in which hearing loss has been reported. Perhaps the urgency of other symptoms such as severe abdominal pain and neurological symptoms have

caused hearing loss to be overlooked in classic lead poisoning patients. Brotto is therefore to be commended for this singular report.



**Figure 2.** Audiogram of a 64-year-old female with bilateral high frequency hearing loss

Congenital syphilis was proposed by Mackowiak, an internist, in 2022 to explain Beethoven's deafness because his father was an alcoholic [9]. However, there is no evidence that his father or mother ever had syphilis. He had none of the accompanying stigmata of congenital syphilis, such as saber shins, mulberry teeth, snuffles, or other findings. Although his autopsy showed atrophic cochlear nerves, the meninges were noted to be thin rather than thickened over the fourth ventricle where the nerves exit the brain stem. Neurosyphilis however, causes thickening of the meninges, and usually involves multiple cranial nerves. Furthermore, none of the 11 physicians that saw Beethoven ever mentioned the diagnosis of syphilis. Congenital syphilis therefore appears to be rather unlikely.

The most recent challenge to lead poisoning is in 2023 by Begg, et. al. who wrote that plumbism does not apply to Beethoven because the Hiller lock of hair in which high levels of lead were found is that of a woman by DNA analysis [10]. Bill Walsh, who was the chief investigator at the Argonne National Laboratory when examination of the Hiller lock was done, stated that the laboratory was not completely certain of its authenticity [11]. This is because of the unknown location of the sample during the second world war. Five samples of

hair have been found by Begg to be from the same male and are "almost certainly authentic." However, none of these locks of hair has ever been analyzed for lead.

One might ask why other cases of lead poisoning with severe hearing loss are not reported from Beethoven's time? There are several possibilities. First, Beethoven was unique in that he liked wine tainted with lead which was exported from Hungary [12]. Lead was added to maintain the flavor during the shipping process. Second, it is well known that he was alcohol dependent, and that in spite of tainted wine causing abdominal distress, he drank it nonetheless [13]. David Hunter, a musicologist, thinks that lead poisoning was more common in that era than we currently realize, and that George Frideric Handel as well as Beethoven had lead poisoning [14]. It wasn't until 1870 when the universal health law was passed in Germany that the working man had adequate access to medical care. Finally, as the causes of hearing loss were not well understood 200 years ago, patients may have had hearing loss from lead, but physicians may not have recognized its causative association.

The cases of hearing loss from chronic lead poisoning due workplace exposure have been mild rather than severe like Beethoven's.



The reason for this disparity is that when symptoms appear or lead levels rise above acceptable guidelines, employment is terminated. Were these patients to continue to be exposed to lead they would develop severe loss just like Beethoven's. Others have wondered how lead could explain all of Beethoven's symptoms and findings at his autopsy. It cannot, but lead and wine can. Chronic lead poisoning results in hearing loss due to axonal degeneration. His abdominal pain is coincident with lead colic, and joint discomfort which he thought was arthritis, is sensory neuropathy seen in patients with chronic lead poisoning. Alcohol is a common cause of cirrhosis of the liver, and pancreatitis seen at his autopsy. Excess alcohol intake commonly causes diarrhea.

### Conclusion

It is a self-evident truth that plumbism does not apply to Beethoven as the hair and bone samples that have been analyzed up to this time are not his. Begg's statement, however, is premature until authentic samples are analyzed. The article explains that future plans by the authors include analyses for toxic substances. However, until that is accomplished, lead poisoning may remain the best explanation of Beethoven's hearing loss. If the analyses do find that lead is absent in authentic hair samples, then the theory of lead tainted wine causing Beethoven's hearing loss will no longer be a valid explanation. Begg may uncover other reasons for Beethoven's hearing loss, but unless that happens its cause may remain an enigma.

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