

## Case Report

DOI: [10.55085/aph.2022.665](https://doi.org/10.55085/aph.2022.665)

# A Description of Lethal Lead Intoxication in Dante's Divine Comedy

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### ABSTRACT

Dante Alighieri is one of the most important authors of Italian and worldwide literature. He achieved lasting worldwide fame with his Divine Comedy. In this work, he reveals an impressive ability to describe medical matters. In this paper we discuss the case of Master Adam the Englishman (Magistro Adam de Anglia) presented in the Inferno as a possible case of lead intoxication induced chronic renal insufficiency.

**KEYWORDS:** Dante Alighieri, Metal Intoxication, Divine Comedy, Master Adam, Lead nephropathy.



Received: 19 Apr 2022  
Revised: 14 Jun 2022  
Accepted: 14 Jun 2022  
Published: 15 Jul 2022

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Cite this article as: Stamatou K, Stamatou A. A Description of lethal lead Intoxication in Dante's Divine Comedy. *Ann Public Health*. 2022;1:665. [\[https://doi.org/10.55085/aph.2022.665\]](https://doi.org/10.55085/aph.2022.665)

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#### Authors' contributions

The participation of each author corresponds to the criteria of authorship and contributorship emphasized in the [Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals of the International Committee of Medical Journal Editors](https://www.icmje.org/). Indeed, all the authors have actively participated in the redaction, the revision of the manuscript, and provided approval for this final revised version.

#### Acknowledgments

None.

#### Funding

None

#### Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

#### Ethical approval

Not applicable.

### 1. INTRODUCTION

Dante Alighieri is universally considered one of the most important authors of Italian and worldwide literature. He also was politician, poet, writer and philosopher. He was member of the Guild of Physicians and Apothecaries (Ars Medicorum et Apothecariorum) however, it is not known whether and if he studied and practiced medicine. Although Dante himself does not provide any information about his early studies, Giovanni Villani, a chronicler from Florence claimed that Dante studied medicine in Bologna [1]. For this reason, it comes as no surprise that medical theories and descriptions of physical disorders and diseases may be found in all his works [2]. Dante achieved lasting worldwide fame with his Divine Comedy (Commedia). It is an epic, narrative poem that is considered one of the most important works in the history of world literature. It was written between 1308-1321 and it has been characterized as the epitome of the medieval world. As such, the Divine Comedy succeeded in condensing the knowledge of the period into its lyrics. In the Early Middle Ages, standard medical knowledge was based chiefly upon surviving Greek and Roman texts, preserved in monasteries and elsewhere however in the second half of the medieval period (c. 1100–1500 AD), it became a formal body of theoretical knowledge and was institutionalized in the universities [3,4]. The University of Bologna (L'Alma Mater Studiorum) which Dante attended had fifteen manuscripts of Galen, four translations of works by Hippocrates and three translations of works by Ibn-Sina and Ibn-Rushd [5]. Dante mentions all four in the 4th song of Inferno (verses, 142-143). Moreover, it has been demonstrated that medical studies in the universities of the medieval world were offered to Master of Arts degree students since medicine was subject of advanced studies. Dante is believed to have attended additional courses at the University of the Sorbonne of Paris, where he may have studied human anatomy and physiology [2]. This may explain the precise descriptions of the human body found thorough his works. Even if there is not much information about his medical education, in the Middle Ages, these texts were indeed known not only to doctors, but also to all intellectuals, since they belonged to common cultural patrimony [6]. The most important fact highlighting Dante's medical knowledge is that he describes previously unknown diseases. The most prominent examples of can be found in the Divine Comedy, Volume 1, Hell (The Inferno).

In this paper we discuss the case of Master Adam the Englishman (Magistro Adam de Anglia) presented in the Inferno as a possible case of lead intoxication induced chronic renal insufficiency.

## 2. CASE PRESENTATION

In the song XXX, of Inferno Dante walks through the pouch that houses the Falsifiers and encounters Master Adam who, having counterfeited the Florentine money, was sentenced to death and was burned at the stake in Florence in 1281. According to the original description he has the shape of a lute, a rotting face, and an abdomen bloated by a disease called 'dropsy'. This term came through the Old French *hydropsie* from the Greek *hydrops* which in turn came from the Greek "hydro" meaning water. Actually, the historical diagnosis of dropsy indicated simply an abnormal accumulation of fluid. This condition, as described by Hippocrates, is characterized by pallor, edema, heaviness and drowsiness and became fatal to the patient's life when accompanied by convulsions.

Today is clearly recognized that the underlying causes of dropsy are congestive heart failure, liver failure, kidney failure, and malnutrition. According to some authors, the description of Master Adam is attributed to liver disease (with more likely cirrhosis of the liver) [7]. However, because underlying diseases were not clearly differentiated before the nineteenth century, a historical diagnosis of dropsy cannot be taken to indicate any one of these alone in the absence of unequivocal supporting evidence [8].

Master Adam and the counterfeiters of his time made their own coins by melting coins and reminting them with a little less gold or silver mixed with lead to make up the weight. They were chronically exposed to lead during counterfeiting and also because they stored quantities of this mineral in their homes. Chronic occupational or environmental exposure to lead, has been linked to a high incidence of renal dysfunction, which is characterized by glomerular and tubulointerstitial changes resulting in chronic renal failure, hypertension, hyperuricemia, and gout. Nephrotoxicity results from lead exposure because the kidney is the main route by which lead is eliminated and in fact, kidney failure develops from years of continuous or intermittent lead exposure [9,10].

## 3. DISCUSSION

The exposition to lead is one of the first environmental health risks in the history of the mankind [11]. The first description was identified in the *Corpus Hipocraticus*, however it was Nicandrus of Colophon the first to make a thorough description of the clinical manifestations of this disease [12]. There was a tremendous increase of use of this metal in times of the Roman empire and it is believed that this facilitated the expansion of the Roman empire and the spread of the Greco-Roman culture. On the other hand, the consequent hyper exposition to lead caused the first epidemic associated with lead intoxication [13]. In the Middle Ages the use of lead decreased and lead poisoning was forgotten, at least in the literature, until the end of the Middle Ages, where it was mentioned sporadically [14]. Yet, lead poisoning remained an occupational disease affecting painters, metal-smiths miners and counterfeiters. Dante was aware that lead has harmful effects on human health. And in fact, in the *Divine Comedy*, *Inferno* (Hell), he provides a pioneering description of the effects of metal intoxication on the central and peripheral nervous system [2]. Walking among counterfeiters, the poet meets some alchemists who suffer from limb paralysis ('che non potean levar le lor persone', *Inf. XXIX*, 72). Some of the counterfeiters appeared to be angry and quarrelsome: ('rabid', *Inf. X*, 33). Both physical (palsy) and behavioral (mood changes) conditions may be due to the use of neurotoxic metals by alchemists [2]. Nowadays is clear that lead may cause acute or chronic poisoning characterized by a variety of symptoms and signs which vary depending on the individual and the duration of lead exposure. Since brain is the most sensitive organ to lead poisoning, most usual symptoms are headaches, intellectual disability memory problems irritability and behavioral problems [15]. Despite accumulate knowledge on lead intoxication, the late remain a significant health issue. Currently, it occurs most commonly in the developing world, however several cases have been reported in the developed world, with the most notorious that of the Flint water crisis [16]. Lead is believed to result in 0.6% of the world's disease burden. According to a study lead poisoning has resulted in 540,000 deaths worldwide [15]. Lead poisoning shares symptoms with other conditions and given the absence of specific findings may be easily missed. The main tool in diagnosing and assessing the severity of lead poisoning is laboratory analysis of the blood lead level. The amount of lead in the blood, as well as the time course of exposure, determine toxicity.

At the time of Dante neither lead toxicity nor nephropathy were known and it was not until the early 1900s that several cases of occupational lead nephropathy were officially reported [17].

Almost 50 years earlier, Richard Bright (born 1789 and studied medicine in Edinburgh and Guy's Hospital) was the first to associate "dropsy" with renal impairment through pathological anatomy findings. He published 23 cases of dropsy, most of them with renal failure. It sounds unreal how Dante could know about lead nephropathy. Probably he didn't. However, he managed to associate counterfeiting with dropsy possibly based on his own observations [18]. Importantly, the Divine Comedy can be described simply as an allegory: each canto, and the episodes therein, can contain many alternative or symbolic meanings. Moreover, in Dante's Inferno, contrapasso (meaning "suffer the opposite") is the punishment of souls "by a process either resembling or contrasting with the sin itself" [19]. Therefore, the clinical picture of known diseases and conditions of the time is used to render the punishment imposed for the actions of the damned while they were alive. Of note, Medieval recognized that certain lifestyles may cause ill health, and some people have a greater predisposition towards bad health than others.

#### **4. CONCLUSIONS**

Divine Comedy is a narrative poem of XIV century that utilizes symbolism to offer a broader moral or deeper meaning for the reader. Medical knowledge of that time was broadly used in the descriptions of the punishments of sins for the sake of comparison or symbolism. Previously unknown or forgotten diseases such lead Intoxication can be also found in the Divine Comedy. In fact, lead intoxication was the cause of the first epidemic ever reported, however in the Middle Ages was forgotten due to the decreased use of lead. Moreover, the association between chronic lead intoxication and renal impairment was unknown. Dante provides the first description of lethal renal insufficiency due to lead Intoxication.

#### **ACKNOWLEDGMENTS**

None.

#### **AUTHORS' CONTRIBUTIONS**

The participation of each author corresponds to the criteria of authorship and contributorship emphasized in the [Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals of the International Committee of Medical Journal Editors](#). Indeed, all the authors have actively participated in the redaction, the revision of the manuscript, and provided approval for this final revised version.

#### **COMPETING INTERESTS**

The authors declare no competing interests with this case.

#### **FUNDING SOURCES**

None.

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