

# Rhazes Diagnostic Differentiation of Smallpox and Measles

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## Abstract

**Background:** Abu Bakr Mohammad Ibn Zakariya al-Razi, known in the west as Rhazes, was born in 865 AD in the ancient city of Rey, near Tehran and died in the same town about 925 AD. He was the first person who distinguished the infectious rashes, in particular smallpox, from measles in a masterful demonstration of clinical observations, providing valid guidelines for the sound treatment of both. This study compares Rhazes Diagnostic Differentiation of Smallpox and Measles.

**Methods:** There is an attempt in this study to compare modern microbiology with the chapters of Rhazes's *fi Al-jadari wa-al-hasbah*. We used this book in its original language (Arabic) along with its Persian and English translations.

**Results:** Rhazes was among the first to recognize the need for sanitation of infected patients in hospitals. Rhazes prepared *Al-Jodari Wa Hasbah*, the first treatise ever written on smallpox and measles for diagnostic differentiation between these two infections, which is the basis for new medicine to diagnose and treat smallpox and measles, according to his experience of patients in hospital. He also noted that the cause of these infections was the yeast transmitted by the blood route. Today, the cause of smallpox and measles is known to be viruses. Rhazes not only classified the type of infections based on location and the time of the appearance of the symptoms in these two infections, but also he scaled the degree of severity and prognosis of infections according to the color and location of rashes.

**Conclusion:** The method of differential diagnosis of measles and smallpox was precisely described based on his clinical experience and observation in hospitals; it is the best reference in the history of medicine for recognition of these two infections. This article is a review of Rhazes's views in medicine and their comparison with the modern microbiology.

**Keywords:** Rhazes; Smallpox; Measles; History of medicine

## Introduction

Abu Bakr Mohammad Zakariya al-Razi (Persian Razi, Latin Rhazes), a versatile physician, philosopher or Hakim, was born in 865 AD in the ancient city of Rey, near the present city of Tehran, Iran. He died there in 925 AD; however, some scholars claim that he was born in 864 AD and died in 930 AD. He is best known for his contributions to alchemy, medicine and philosophy, ethics in medicine, and metaphysics and au-

thored 184 books and treatises on these subjects.<sup>1</sup> At age of 30, Razi began his medical and philosophical studies under Ali Ibn Rabban al-Tabari, a physician-philosopher from the ancient city of Merv in western Iran.<sup>2</sup> He was follower of Avicenna who made advances in pharmacology and in clinical practice and created a system of medicine that today we would call holistic and in which physical and psychological factors, drugs, and diet were combined in treating patients.<sup>3</sup> He has several compilations including *Al-Havi*, *Al-Mansouri*, *Al-Morshed*, *Al-Jodari* and *Al-Hasbah*. His last book is related to smallpox and measles and Razi makes a number of precise observations in it, not described previously. Among these observations, he

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writes, "smallpox appears when the blood boils and is infected, resulting in vapors being expelled. Thus, juvenile blood is being transformed into richer blood, having the color of mature wine. At this stage, smallpox shows up as blisters essentially as bubbles found in wine. This disease can also occur at other times, not only during childhood. The best thing to do during this first stage is to keep away from it; otherwise, it might turn into an epidemic." Also, Razi noted that the illness was transmitted from person to person. His explanation of why survivors of smallpox do not develop the disease for the second time is the first theory of acquired immunity.<sup>3</sup> In differentiating smallpox from measles in his book of *al-Judari wa al-Hasbah*, Razi wrote "The eruption of smallpox is preceded by a persistent fever, pain in the back, itching in the nose, and terrors in the sleep". These are the more peculiar symptoms to approach, especially a pain in the back with fever; pricking which the patient feels all over his body, a fullness of the face which at times comes and goes; an infectious color, and vehement redness in both cheeks; redness of both eyes, heaviness of the whole body; great uneasiness, presenting as stretching and yawning; pain in the throat and chest, with slight difficulty in breathing and cough; dryness of breath, thick spittle and hoarseness of the voice; pain and heaviness of the inquietude, nausea and anxiety; (with this difference that the inquietude, nausea, and anxiety are more frequent in measles than in the smallpox; while the pain in the back is more peculiar to the smallpox than to the measles), heat of the whole body; an inflamed colon, and shining redness, especially an intense redness of the gums.<sup>4</sup> The May 1970 Bulletin of the World Health Organization paid special tribute to Razi, stating that "his writings on smallpox and measles show originality and accuracy, and his essay on infectious diseases was the first scientific treatise on the subject." Razi was a pioneer in many areas of medicine particularly in the fields of pediatrics and infectious diseases.<sup>5</sup> Eastern and western writers in history described Rhazes' works as medical encyclopedia and called him "Rhazes, the encyclopedist."<sup>6</sup> In this paper, we study Rhazes' method of recognizing and treating smallpox and measles, his differential diagnosis of both diseases, and also compare it with modern medical information about both diseases.

### Materials and Methods

This study is an attempt to compare modern medicine with the chapters of Rhazes's *Treatises on Al-jadari*

*wa-al-hasbah*. We used this book in its original language (Arabic) along with its Persian and English translations. We compared these sections to the current microbiological findings. Selected topics from this book are presented and a brief discussion follows each subject. Although we tried not to deviate from mere scientific discussion, there is, undoubtedly, the probability of mistake due to the difficult nature of such historical studies. This article can be an opening to comprehensive studies on better exploring our ancestors' works.

### Discussion

Smallpox or variola is known as an acute and contagious disease caused by pox viruses. Smallpox appears in three major forms: variola major, alstrim and varioloid. Smallpox is identified by particular symptoms in the primary stage of the disease and the appearance of skin rashes which develop through different stages from maculae to postule and from pock-marks at the end.<sup>7</sup> The smallpox virus enters the body via the upper respiratory tract. The incubation period of smallpox is 7-17 days. Fever appears one to five days before the appearance of exanthemas. These rashes become in turn popular, vesicular and ultimately change to pustular and develop crusts. Fever decreases after rashes break out. The smallpox pustule is one centimeter in diameter, circular in form and deep in the skin. The rashes are hemorrhagic in the case of the acute form of the disease, and its death rate is more than 90 percent.<sup>6</sup> The rate of death in variola alastrim is lower than one percent. Measles is an acute contagious disease with symptoms such as maculopapular pustules, fever and respiratory disorders. These diseases are caused by virus from the paramyxo virus family. The duration of incubation of the disease before the onset of fever is ten days and until the appearance of measles pustules is 14 days.<sup>8</sup> The disease is accompanied by fever, sneezing, watery nose, eye redness, Koplik spots, and lymphopenia. The fever and coughing persist until the appearance of skin pustules and disappear after 1-2 days. Skin pustules spread all over the body during 2-4 days and afterwards the color of the pustules changes into brown. The symptoms oit, but decrease quickly after that.<sup>8</sup> In some cases, measles causes pneumonia, otitis, and bronchitis. Measles encephalitis is one of the dangerous complications of the disease.<sup>8</sup>

At the end of chapter one of his book about smallpox, Rhazes indicates the cause of smallpox and its transmission by yeast via blood. The idea of Rhazes about the cause of infection is similar to that known today. Rhazes distinguishes different types of smallpox and also pinpoints its differences from measles; he determines whether the disease is benign or malignant. He describes the symptoms of smallpox and measles in the third chapter of his book, and notes the eruptions and the complications of the sickness in chapter four. Rhazes notes the examination of the eyes, throat, joints and ears in the seventh chapter of his book and indicates when symptoms point to smallpox.<sup>8</sup> He also indicates the benign and lethal forms of smallpox and measles in chapter fourteen of his book, presenting the symptoms that determine whether they are benign or lethal. He states that having healthy respiration and mental faculties, a desire for food, agility of movement, normal pulse, comfortable sleep, and low stress are signs indicating that the disease is harmless, and notes that the benign type of smallpox appears with limited blisters with no hardship or high fever, while lethal smallpox appears with widespread spots and fever.

We understand from Rhazes' writings that he observed different stages of the appearance of the spots and afterwards the decrease of fever and the patient reaching comfort. He notes that severe blistering is malignant and lethal.<sup>9</sup> White and tiny blisters which become confluent, severe, dried and warty are malignant, causing degeneration in tissues and the patient's uncomfortable after the appearance of spots; this indicates lethal prognosis. Green, violet black blisters all are lethal, and shortness of breath and swooning are the worst symptoms of dangerous smallpox, which corresponds to acute smallpox with hemorrhagic rashes, where death rate is ninety percent.<sup>6</sup> He indicates that whenever a high fever follows the appearance of blisters, smallpox is malignant, but if the fever decreases it is benign.

He said in another description of smallpox that when rashes appear on the first day with fever, it is an acute kind of smallpox, whereas fever without spots on the third day indicates the intermediate kind of the disease, and if the fever extends into the fourth day and no spots appear, this is mild smallpox. On the other hand, the best prognosis of measles is in the case of light redness, whereas measles with dark rashes is malignant. Measles with green and violet spots is dangerous if the spots appear suddenly, and produce severe illness with swooning.<sup>10</sup>

Rhazes is known for using cotton in the prevention of wounds in smallpox patients. He used cotton soaked in rose water, camphor in the nose of patients for prevention of symptoms in measles and smallpox. For prevention of eye problems in smallpox, he used two kinds of drugs, dropped in the eyes; first, rose water, and second, a kind of collyrium that was a mixture of antimony. In addition, he used an ointment rubbed on the eyes.<sup>11</sup> He used diuretics such as beers, verjuice, watermelon chicory, and jujube and also environmental treatments such as cold air. The use of drugs by Rhazes for treatment of smallpox and measles in his book *Al-jodari* and *Al-hasbah* relies on his experience of case presentation. The discussion by Rhazes about measles and smallpox, their occurrence and prevention, and their effect on body organs is highly scientific; necessitating more attention to be paid to how a physician of early times treated these diseases and to his observations in all aspects.<sup>7</sup>

Rhazes is rightly considered one of the greatest medical practitioners and writers in the period between Galen and the Renaissance reemergence of medicine as an empirical discipline.<sup>12,13</sup> He was a rationalist, extremely confident in the power of reason, free from every kind of prejudice, and daring in the expression of his thoughts.<sup>1</sup> He was described as outstanding in generosity and always willing to treat and help the poor. He was an independent thinker and not afraid to rely on his own observations when they contradicted the past. He counseled others saying "All that is written in books is worth much less than the experience of a wise doctor." Razi's fame rested on clear-cut clinical descriptions of illnesses, original observations, and a pragmatic approach to treatment. He gave the first accurate descriptions of smallpox and measles, advised proper food as preferred to drugs in treatment, and recommended simple rather than complex remedies. Indeed, the clearest description of smallpox from pre-modern times was given by Rhazes, who was the first to differentiate smallpox from measles and chickenpox in his *Kitab fi-al-jadari wa-al-hasbah*.<sup>1</sup> Rhazes' book on smallpox and measles provides further evidence of his clinical acuteness as well as valuable information about diagnosis, therapy, and concepts of disease. According to Rhazes, smallpox was caused by impurities in the blood derived from bad menstrual blood that had been present during gestation. Measles, which Rhazes recognized as a separate disease, was caused by very bilious blood. However, even an experienced physician might have trouble distinguishing smallpox from

measles. To protect this reputation, the physician should wait until the nature of the illness is obvious before giving this diagnosis. Proper management before the onset of smallpox might lessen its virulence, but when the disease is inevitable, the physician should encourage eruption of the pox by wrapping, rubbing, steaming, purging, and bleeding and take special precautions to prevent blindness. According to Rhazes, pustules that become hard and warty rather than ripen properly indicate that the patient would die. Various recipes were supposed to remove pockmarks, but the rather universal presence of smallpox scars suggests that these remedies which included sheep dung, vinegar, sesame oil, and the liquid found in the hoof of a roasted ram were about as useful as

modern wrinkle creams. In reality, once smallpox appeared, medicine could do little to alter the course of the disease; it just worsens the disease, but a proper regimen gives the physician and patient a sense of control, comfort, and hope.<sup>14</sup>

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