REVIEW ARTICLE

# Causes of Neonatal Stroke: Ibn Thalaj's (Died in 975 AD) Viewpoints

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## ABSTRACT

Although stroke has long been recognized as an adult health problem that causes significant morbidity and mortality, it is also an important cause of brain injury in infants and children. The present article deals with this issue from the perspective of medical history. Physicians have tried throughout history to diagnose and treat this disease. One of the physicians who first accurately described this disease was Ibn Thalaj, who died in 975 AD. The hypotheses that he has raised about the causes of neonatal stroke, along with his recommendations for prevention and treatment, are intriguing. Exploring these hypotheses highlights the ongoing human endeavor to comprehend and combat diseases.

## Introduction

The prevalence rate of ischemic stroke in infants is 0.6 to 7.9 per 100,000. Reports indicate that this rate has exhibited a rising trend since 1980. While no apparent reason exists for its occurrence yet, researchers have presented many involving risk factors (1). The assessment of articles in the databases around the history of neonatal stroke indicates that the role of all physicians has not been specified completely, and the experiences of prominent and famous schools of medicine have not been transferred comprehensively (2, 3). According to the discoveries of archaeologists, human knowledge regarding stroke disease in adults dates back to the first half of the second millennium B.C. (4). The first footprints of recognizing this disease or similar diseases in infants can be attributed to Hippocrates. Ali ibn Sahl Rabban al-Tabari,(838-870 AD) in his book, refers to the symptoms of this disease. Although

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he has not named the disease explicitly, he quotes from Hippocrates: "*Infants' arteries are narrow, and their blood does not have the necessary heat. This causes blood clotted in the arteries, leading to death. If moistures remain in the brain, it closes the way of ducts and causes the infant's death" (5)***.** After Hippocrates, Paul of Aegina's physician (625-690 AD) paid for this disease and stated its symptoms and treatment methods (6). However, the complete explanation of neonatal stroke disease can be found in the book of a physician named Ibn Thalaj, who has paid to this disease in detail and has brought ways to identify, prevent, and treat it (7).

Ahmad Ibn Mohammad Baladi, known as Ibn Talaj, was born in Balad (one of the cities of present Iraq), studied in the presence of great Persian physician Al Ahmad ibn Abi al-Ash'ath (died 975 AD), who was one of the commentators of the Galen books (129-210 AD). The book "*Tadbir al-Hubala wa-al-Atfal*" is among his highlighted works. This book is the most complete and best on pediatrics and health for many years after the Renaissance. This book is by conventional medicine and describes issues related to the health and diseases of mothers, infants, and children, based on opinions of ancient and contemporary physicians and his own scientific experiences. The book consists of three chapters and 166 sections (8). Ibn Thalaj lived chronologically after Rhazes (865-925 AD) and before Avicenna (980-1037 AD) (9, 10).

The terminology presented in Ibn Thalaj's book indicates that his perspective on the topic of stroke aligns with that of Rhazes and other Persian physicians in general. Still, the plan of stroke in infants and the prevention and treatment methods are among the topics he has discussed in the medical books for the first time in the Islamic period. He has utilized the book on the Regimen and Therapy of Children by Paul of Aegina to diagnose this disease (7). However, a small part of the Paul of Aegina's book has remained. The exact extent of Ibn Thalaj's contributions to this work is unclear. However, the earliest detailed discussion of neonatal stroke can undoubtedly be found in Ibn Thalaj's book.

## 1. Mechanisms of stroke creation, causes, symptoms, diagnosis, treatment, and prevention of neonatal stroke from the viewpoint of Ibn Thalaj

### 1.1. Mechanism of stroke creation in infants

Ibn Thalaj says in this regard, "*Filling the ventricles of the brain with thick lymphatic phlegm causes that this phlegm prevents the penetration of the carnal soul from the brain to the spinal cord and nerves, and impairs the senses, movements, and actions of the body organs*" (7, 11). Perhaps what is called a *carnal soul* in the expression of Ibn Thalaj, we can interpret it today as electrical signals emitted to the brain neurons that flow in the path of spinal and peripheral nerves and cause the sensation and movement of organs.

### 1.2. Diagnosis of neonatal stroke

According to Ibn Thalaj, strokes in infants differ significantly from those in adults. The incidence and complications of strokes in infants tend to be lower. However, the onset occurs more rapidly, and infants typically recover more quickly. He notes that vital signs may not be apparent when an infant experiences a stroke, and symptoms such as movement and sensation can resemble those of death. A stroke can be identified by prolonged chest movement and weak breathing. Due to this reason, he warns that there have been instances where infants who suffered strokes were

mistakenly buried alive (7).

### 1.3. Causes of stroke incidence in infants

Ibn Thalaj knows the infant's moisture temperament is one of the potential incidences of stroke and states that the moisture in the infant's temperament, brain, and food causes stroke incidence. Correspondingly, Rabban al-Tabari, a prominent Persian physician who passed away in 870 AD and lived long before Ibn Thalaj, noted that if moisture and phlegm accumulate in an infant's brain, it can cool the blood and restrict its flow. This condition could ultimately result in the infant's death (5).

### 1.4. Constipation or milk retention in the stomach

Constipation causes congestion and milk retention in the stomach and gastrointestinal system. The steam produced from the contents of the stomach and other waste materials rises from the lower parts of the body to the upper parts. Reaching the brain, increasing its moisture, and creating fullness in the brain's ventricles can cause stroke in infants.

### 1.5. Milk spoilage

Ibn Thalaj also knows milk spoilage as one of the reasons for neonatal stroke incidence and states that "*if the mother consumes poor quality foods, it will make her sick and spoil her milk and at this moment transmit the disease to the infant and then stroke happens in the infant due to blocking in the gastrointestinal system*" (6).

### Drinking too much milk

Drinking too much milk causes fullness, one of the causes of infant stroke. Of course, fullness is also one of the causes of stroke incidence in adults, as mentioned by great Persian physicians such as Avicenna and Rhazes. However, Ibn Thalaj considers drinking too much milk and the rising fullness accompanied by constipation factors to cause a stroke. He also states that stroke occurs more often among obese infants (7).

## 2. Therapeutic strategies

### 2.1. Hoque (sending fluids into the body via the anus)

If a stroke occurs, address the buildup of waste materials in the brain. This can be managed by using a laxative suppository or by performing hoqne is crucial. Hoqne is done with laxative drugs that have been built in liquid form. Ibn Thalaj also quotes Paul Ignatius, who says that if a stroke occurs, the infant should be purified with cabbage extract in which salt has been dissolved (6).

### 2.2. Force the infant to vomit

The infant's mouth should be opened and pushed to the end of the tongue with the finger (this action is probably recommended to shock the infant for the infant's restoration of consciousness). Then, impregnate a chicken feather with oil and insert it into the infant's mouth. This work helps the infant vomit materials from the stomach (7).

### 2.3. Bathing the infant

After applying pressure on the root area of the tongue, bathing should be done with special water. Using seawater and boiling plants such as thyme, marjoram, chamomile, rosemary, and caraway is better. If seawater is unavailable, adding salt to ordinary water and bathing the infant is possible. The infant's head should be kept warm after bathing, the body should be protected against the cold, and breastfeeding should be reduced

gradually. This process should be continued daily for up to twenty and even forty days. These measures should be performed without harming the infants (7).

### 2.4. Milk modification

Although the books of "*Tadbir al-Hubala wa-al-Atfal*" only mention milk modification and do not mention how to do it, it can be found from other books by Persian physicians mention that breast milk can be modified by avoiding slow-digestible foods and consuming easily digestible foods (12).

### 2.5. Prevention of incidence of stroke in infants

Given the reasons mentioned by the physicians for stroke incidence, seemingly, many of the usual neonatal care recommended by them have been performed with the aim of stroke prevention. However, other goals might have been followed.

One reason for stroke is milk spoilage; physicians have mentioned some properties that distinguish healthy milk from spoiled milk. Avicenna says, "*Healthy milk should be neither too thick nor too thin in concentration, it should not have a strange smell and scent, its taste should be inclined to sweet, and its color should be white, and milk whose color has a great tendency to yellow, green or black, is spoiled. The infant should be breastfed with a midwife*" (13).

Another issue that can cause stroke is drinking too much milk. In this regard, physicians have recommended the proper amount of breastfeeding for infants. For example, Rhazes, in Al-Mansouri's book, knows the number of times a newborn baby breastfeeds twice a day (14).

Constipation and milk retention in the stomach are other factors that cause fullness and neonatal stroke. One reason for milk closing in the stomach is synchronicity in drinking milk and sour juices. Some physicians have forbidden giving milk with sour juices to infants (15).

## In Conclusion

Medical knowledge is not exclusive and belongs to any particular civilization or medical school. It has been completed throughout history, like the components of a puzzle, with the help of experiences and their transfer between civilizations. At some points in history, this evolutionary process has progressed faster and, at some points, slower. Although the diagnosis of diseases and their treatment have been excellent with the help of new technologies in the present time, the main basics and their historical course should never be neglected in these scientific advancements. Modern medicine has achieved tremendous progress in various fields, including pediatric neurology. However, this degree of development has not happened suddenly and is not unique to the present century; it has also been acquired during different centuries with synergy in experiences and knowledge. Undoubtedly, facing the researchers in this field of medicine with traditional physicians and assessing their theories and beliefs in diagnosing, causing, and treating stroke in children have many attractions and benefits.

This fascination will culminate in the depth of medical history, which sometimes subconsciously reveals sparks of similarity or approximation of minds to new findings. Medicine is knowledge combined from science, experience, philosophy, art, and history. It is impossible to achieve its goal and accurate understanding without a comprehensive study and familiarity with its origins.

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## Authors' Contribution

Mohammad Hossein Asadi, and Saeed Changizi-Ashtiyani, Saeed Amini searched data bases and involved in prepared the drafts of the manuscript. Asadi MH, Changizi-Ashtiyani S and Amini S finalized the manuscript.

## Conflict of Interest

The authors declared no conflict of interest.

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