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## Fundamental Tenets of Nipah Virus Infection in Ayurveda and its Management: A Multidisciplinary Investigation

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### ABSTRACT

**Introduction:** In 1998, a flare-up of outbreak encephalitis with high death rates among pig handlers in Malaysia prompted the disclosure of a novel paramyxovirus named NIPAH infection. Total 12 deaths due to the deadly NIPAH virus have been reported so far from northern Kerala. Ayurved do believes in microorganisms and their role in disease, but emphasizes more on body's response and occurrence of disease occurs only if the *Bala* is reduced.

**Objective:** To analyze the epidemiology of NIPAH virus (NiV) and various principles of Ayurveda relevant to interpret their contemporary significance.

**Methodology:** A multidisciplinary examination that included the study of disease transmission, pathogenesis, transmission and ayurvedic intervention was vital in the disclosure of this new human contamination. The work is mainly based on theoretical research using standard Database, Journals and websites for collecting data regarding to NIPAH virus and textbooks of epidemiology and classical treatises of Ayurveda.

**Discussion:** In this investigation, endeavor has been made to comprehend these ideas in the light of the study of disease transmission of NIPAH infection with their most estimated outline. In Ayurvedic points of view, it comes prior under the classification of Vata Shlaishmik (cautions at first), which additionally extends to Sannipataja jwara. The symptoms of vata Shlaishamik jwar in Sushruta resemble with the early symptoms of NIPAH virus and *Abhinyas jwar (Sannipataja jwara)* meet resemble with the symptoms of late stage of NIPAH virus.

**Conclusion:** It is intriguing to take note of that the concepts described hundreds of years back are especially relevant at this present period and their significance can't be ignored.



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**KEYWORDS** *Ayurveda, NIPAH virus, epidemiology, communicable disease, Vata Shlaishmik jwar, Sannipataja jwara*



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## INTRODUCTION

Ayurved believes in microorganisms and their part in ailment, however underlined more on body's reaction and event of occurrence of disease happens when Bala is reduced. The essential standards depicted in Ayurveda are as yet the same as the present therapeutic science. A decent number of standards are found in the traditional writings of Ayurveda, which can be contrasted and the ideas of the study of disease transmission, the standards described in piecemeal can be aggregated, investigated, and deciphered in the light of current hypotheses of the study of disease transmission.

Nipah infection (NiV) is a zoonotic paramyxovirus that causes serious ailment in people frequently showed as encephalitis<sup>[1]</sup>. Cases may likewise give intense respiratory disorder, showed as hack with respiratory trouble and with neurological side effects<sup>1-4</sup>.

### Reservoir of virus

The natural reservoir for NiV is fruit bats of the genus *Pteropus*, which are found in eastern Africa and Asia, Australia and the Pacific islands. A sero epidemiologic consider in Malaysia ensnared 4 fruit bat species, *P. hypomelanus*, *P. vampyrus*, *Eonycteris spelaea*, *Cynopterus brachyotis* and insectivorous bat *Scotophilus kuhlii*.<sup>5</sup>

Nipah virus has been separated from the brain and spinal fluid of victims in Malaysia<sup>5</sup>. Infective virus has also been detached from bat urine and partially eaten fruit in Malaysia<sup>6</sup>. *Pteropus medius* (formerly *P. giganteus*) is the only pteropid bat species present in India<sup>7,8</sup>.

### Epidemiology

Nipah was first recognized as the etiologic agent causing outbreaks in pigs and encephalitis in humans in Malaysia<sup>9</sup> and Singapore during 1997–1999<sup>10</sup>. Thereafter, this infection was recognized as the cause of outbreaks of human encephalitis in India and Bangladesh during 2001<sup>11</sup>. Consistently since 2001, NiV has caused episodes among people in Bangladesh; cases are additionally revealed in circumscribing regions of India<sup>12</sup>. The biggest of these outbreaks included sixty six persons, primarily healthcare workers, in Siliguri, India, in 2001<sup>12</sup>. Presently Kerala has been on high risk because of mysterious deaths of twelve people because of Nipah viral attack. According to the NIV (National Institute of Virology), Pune, Nipah Virus is the main cause of these deaths<sup>13</sup>.

### Mode of Transmission:

Contaminated bats shed infection in their discharge and emission, for example, urine, saliva, semen and excreta yet they are symptomless transporters. The NiV is



exceedingly infectious among pigs, spread by coughing. 90 percent of infected people in the 1998- 1999 outbreaks were pig farmers or had contact with pigs<sup>14</sup>. There were central flare-ups of Nipah in India during winter in 2001<sup>15</sup>. Drinking fresh date palm sap, may be contaminated by fruit bats (*P. giganteus*) during the winter, may have been in charge of indirect transmission of Nipah virus to humans<sup>16</sup>. There is a fortuitous proof of human to human transmission in India<sup>17</sup>.

### **5. Sign and Symptoms**

Normal clinical symptoms are seen in pigs where respiratory symptoms dominate. Nipah infection ailment in pigs is otherwise called porcine respiratory and neurologic syndrome and also barking pig disorder in view of clinical observation.

Manifestations of NiV infection in humans are like influenza such as fever and muscle pain. Sometimes inflammation of the brain occur leading to coma or disorientation. Encephalitis may present as acute or late onset<sup>18</sup>. After introduction and an incubation period of 5 to 15 days, illness presents with 3-15 days of headache & fever, followed by confusion, drowsiness & disorientation. These signs and symptoms can lead to coma within 1-2 days.

A few patients have a respiratory ailment during the earlier phase of infections, and some patients showing

severe neurological & pulmonary signs. Further, those patients who recovered from an acute episode may also have a relapse. The case casualty rate ranges from 10 to 75%<sup>18</sup>.

During the Nipah virus disease outbreak in 1998-99, 265 patients were infected with the virus. About 40% of those patients who entered hospitals with serious nervous disease died from the illness<sup>19</sup>. Long term sequelae following Niv disease have been noted, including personality changes and convulsions.

### **6. Role of the Immune system and Survival Factors:**

NIPAH virus weakens the immune system making it difficult for the body to response. The first defensive response of the immune system is to recognize and bind to the viral proteins. This is a double-edged sword, because this is also the easiest way for the cell to become infected.

Immune cells (B-cells) bind to Nipah virus and produce IgG and IgM antibodies to enroll other immune cells to neutralize the infection. In a investigation of 2013 in Georgia (USA), the researcher looked at the immune responses of blood samples from survivor and non survivors of this outbreak. It was discovered that survivors had created antibodies against different proteins of the virus<sup>19</sup>.



These antibodies were still active in the survivors after the infection had passed. In a twelve year follow-up study with the survivors, the immune systems still carried IgM and IgG antibodies against the viral proteins.<sup>29</sup> These individual still produced a significant immune response to injected viral proteins over 10 years after presentation to Niv infection.

These studies perceive the role of the immune system in survival. For an infection like Nipah virus, which has no apparent clinical cure, natural reinforcement of the immune system may represent an oasis of hope in the desert of fear and panic.

- **Ayurvedic Concept of Immunity (Vyadhishamatva):**

Our actions like Eating at odd times, Emotional eating, Eating wrong food combinations, Working late hours into the night, Sleeping late, and Weak emotional capabilities leading to expressions of Anger, Continuous exposure to stressful situations, Hate, Fear, Lust, Greed etc weaken the body's immune system.

All the actions that one indulges in robs one of the vital essences of our energy called "Ojas" the life energy. This helps in energizing cells of our body, maintains healthy cellular intelligence and keeps our whole being in good shape, physically, mentally, emotionally and spiritually. Ojas

is formed as a result of the well digested and assimilated food in a well maintained metabolic heat in the body. Along with the formation of the Rasa Dhatu (nutrition derived from the assimilated food that helps in forming healthy Plasma to form blood, Ojas helps in maintaining healthy balance of energies in the body and also builds up **Vyadhishamatva** (immunity).

By indulging in unhealthy activities of both *Sharir* and *man*, both *Ojas* and the *Rasa dhatu* get depleted as they are in short supply. The net result is the body succumbing to ailments. By regulating our lifestyle, our food habits and following certain essential guidelines of Ayurveda common to all constitution types, we can be assured a long and healthy life.

### **Cause of Epidemic according to Ayurveda**

Charaka describes the communication of disease through water, air, etc and the Sushruta despites communication through contacts<sup>20</sup>. Combating these elements is to be done by various methods i.e. ceasing the progression, boost the immunity against infection and treating them. Chakrapani describes that individuals defer in strength, food habits, immunity, suitability, physical constitution, etc, they do get influenced with disease by vitiation of few factors that are common to each one of the individuals<sup>21</sup>.



The factors water, air, land and season are common to all the individuals in a community include. These factors also affect the whole community resulting in widespread of disease, known as **Janapadopdhwansa Rogas**<sup>21</sup>.

According to Charaka, disease is only due to amalgamation of Dhatus and Doshas and impartation of vitiated qualities of Doshas over Dhatus<sup>20</sup>. This legitimizes Body's immune system plays vital role in production of diseases.

### **Ayurvedic Concept in the etiology of Nipah Virus**

Many diseases may have one common manifestation; like Jwara is the common manifestation seen in many diseases. Many diseases have many manifestations; like other features than Jwara in this example. One disease may have one manifestation like in “ज्वर प्रत्यात्मिकं लिङ्गं सन्तापो देहमानसः”. One disease may have many manifestations like other ling and upadrava in case of jwara. This concept of Ayurveda is considered as **Vyadhi Sankara**<sup>22</sup>. The same concept can be applied in case of etiological factor. Many etiological factors can cause one disease or may cause many diseases. This concept of Ayurveda is considered as **Hetu Sankara**<sup>23</sup>.

The concept of **Nidanarthakara Roga** is a unique concept of Ayurveda. It means that one disease may lead to other disease, if we talk about Nipah, Encephalitis may present as intense or late beginning<sup>24</sup>.

Close body contact via body secretions via breath, by using clothes, utilization of sitting, sleeping place etc. All these are the etiological factors for the **Sankramika Roga** like kustha, Jwara, Sosha, Netrabhishyanda<sup>25</sup>.

In Rasa-gata Jwara features like Myalgia, Pyrexia, yawning may be present. In Rakta-gata Jwara features like excessive thirst, petechiae, impaired orientation, hemoptysis, discoloration, burning sensation and consciousness etc are seen<sup>26</sup>.

Nipah disease is caused due to strong etiological factors and the signs and symptoms are extremely showed then it will lead to unconsciousness, drowsiness, disorientation and kill the patient in the case of Nipah Virus<sup>27</sup>. If the Doshika jwar is being manifested with all its features then it will kill the individual in 7, 10 and 12 days in case of vatika, pittaja and kaphaja Jwara respectively and major features observed will be inappropriate talking malaise, respiratory symptoms like breathing difficulty respectively.

### **Possible Correlation in Ayurveda:**

In Ayurvedic perspectives, it comes earlier under the category of **Vata Shlaishmika**



*jwar* (warns initially), which further extends to *Sannipatika jwara*.

There are 3 types of Dvandaja jwaras and have the symptoms of two aggravated doshas together. In earlier phase in Nipah, the Vata and Kapha doshas are aggravated. In the description of **Vata Shlaishmaja jwar** Sushruta include Rigidity, Joint pains, more of sleep, feeling of heaviness, headache, moderate heating are the features of Vata Sleshma Jwara. It can be correlated with the observed symptoms fever, headache and general malaise in earlier Stage of Nipah virus as described in Table 1.

स्तैमित्यं पर्वणां भेदो निद्रा गौरवमेव च ॥  
शिरोग्रहः प्रतिश्यायः कासः स्वेदप्रवर्तनम् ।  
सन्तापो मध्यवेगश्च वातक्षेष्मज्वराकृतिः ॥  
(सुश्रुत उत्तर 39/48-49)

**Table 1** Comparative Sign and Symptoms of Vata Shlaishmik jwar and Nipah virus in Earlier Stage are as follows

S.N.	Nipah virus	Vata Shlaishmik jwar
1.	Moderate temperature	Santapo madhya vegascha
2.	Sleepiness	Nidra
3.	Malaise	Gaurav
4.	Headache	Shirogrih
5.	Early Respiratory Symtoms	Pratishyay, kasa,

Sushruta describe some special kinds of jwar under ‘vishesh sannipatik jwar’, which is-**Abhinyas Jwar**.

In the description of “**Abhinyas jwar**”, Sushruta told that moderate increase of

body temperature, loss of consciousness, loss of complexion, dyspnoea, debility, unsteady eyes, loss of voice, coarse tongue, absence of sweat, faeces and urine, discomfort in the chest, dryness of throat, aversion to food, falling from the cot and lies on the floor, suffers from irrelevant talk with these symptoms the fever is called *Abhinyasa jwara* and as *Hataujasa jwara* by some others. It can easily correlate with the clinical symptoms of later phase of **NIPAH** virus as described in Table 2, which include Neurological symptoms and respiratory symptoms, which further become more severe with leading in coma, Sushrut describe this condition under **Sannyas**<sup>26</sup>.

नात्युष्णशीतोऽल्पसञ्ज्ञो भ्रान्तप्रेक्षी हतस्वरः  
| खरजिह्वः शुष्ककण्ठः स्वेदविण्मूत्रवर्जितः  
॥

सास्रो निर्भुग्नहृदयो भक्तद्वेषी हतप्रभः ।  
श्वसन्निपतितः शेते प्रलापोपद्रवायुतः ॥

तमभिन्यासमित्याहुर्हतौजसमथापरे । (सुश्रुत  
उत्तर 39/39-41)

**Table 2** Comparative Sign and Symptoms of *Abhinyas jwar* (*Vishesh Sannipata Jwar* in Sushruta) and *Nipah Virus* (in late stage) are as follow:

S.N.	Nipah virus	Abhinyas jwar
1.	loss of consciousness	Alpa-sangya
2.	Disorientation	Bhrantpekshi
3.	Sore throat	Shushak kantha, hat swara
4.	discomfort in the chest	Nirbhugna hridayo
5.	Dyspnoea	Shwashan nipatitah
6.	Dellirium	Pralap





सन्निपातज्वरं कृच्छ्रसाध्यमपरे विदुः॥  
निद्रापेतमभिन्यासं क्षीणमेनं हतौजसम्।  
सन्यस्तगात्रं सन्यासं विद्यात् सर्वात्मके ज्वरे  
॥ (सुश्रुत उत्तर 39/41-42)

सन्निपातज्वरो असाध्यः

कृच्छ्रसाध्यस्त्वतो न्यथा ॥ (च. सू 3/109)

Sushruta said that Sannipata jvara is Krichhsadhya (difficult to cure); Charak others say it is either incurable or difficult to cure. Among sannipata jvaras, abhinyasa jvara should be understood when the patient has more of sleep; hatuajasa when there is loss/decrease of ojas (essence of tissues) and sannysa when there is loss of conscious activity of the body<sup>27</sup>.

In a study of 2000-2005 in Bangladesh; researchers find that after exposure illness presented with 3-15 days of headache and fever, disorientation, drowsiness & mental confusion. These signs and symptoms progressed to coma within 24-48 hours. Researcher find that Among those who died, death occurred a in median of 8 days (range, 6–14 days) and if we talk about sannipata jwara, the fever increasing greatly on reaching the 7<sup>th</sup>, 10<sup>th</sup> or 12<sup>th</sup> day either subsides or kills the patient. So we can understand that the **fatal period of Nipah virus is similar to Sannipata jwara**<sup>28</sup>.

## 10. PREVENTION AND CONTROL:

### 10.1 According to modern medical Science

There is no any effective treatment for Nipah, but **Ribavarin** may alleviate the symptoms of vomiting, nausea and convulsions.<sup>30</sup> Treatment is focused on overseeing fever and neurological symptoms. ALVAC Canarypox vectored Nipah F & G vaccine are a promising vaccine for swine and has potential as a immunization for humans.<sup>31</sup>

### 10.2 Ayurvedic Approach in the Management of Epidemic Diseases

In Ayurveda it is believed that infective agents producing bodily disease also affect the mind<sup>32</sup>. Therefore three fold management has described. **Daivavyapashrya** and **Satvavajaya** are the methods, help in correcting state of disturbed Psyche which help in potentiating immune system of body<sup>33</sup>. **Yukti Vyapashrya Chikitsa** is thought to be more imperative as certain particular measure against disease are carried out, including medications, purifications, surgical interventions etc<sup>34</sup>.

### 10.3 Ayurvedic approach in the management of NIPAH

- **Chikitsa Sutra (Concept of management):**

Treatment in NIPAH Virus mainly follows the Sannipata jwara chikitsa. In sannipata jwara, it is difficult to treat the patients, therefore only way to treat the patients by



reducing the aggravated dosha, even if it means aggravation of other doshas.

संसृष्टान्, सन्निपतितान्, बुद्ध्या तरतमैः

समैः।

ज्वरान्, दोषक्रमापेक्षी यथोक्तैरौषधजयेत्॥

(च.सू. 3/285)

In Dwandaja and sannipata jwara the selection of medicine should focused on the tara- tama measure of dosha. Doshas may be aggravated/pacified or more aggravated/pacified.<sup>38</sup>

वर्धनेन एकदोषस्य क्षपणेन उच्छ्रितस्य वा॥

कफ स्थानानुपूर्व्या वा सन्निपातज्वरं

जयेत् ॥ (च.सू. 3/286)

In sannipataj jwar, firstly steps should be taken to pacify kapha dosha, Kapha Shaman Chikitsa is done initially then after pacifies the aggravated doshas and aggravate the ksheen dosha but mainly kapha shaman measure should be initiated, then after Pitta and Vata Shaman Chikitsa.<sup>38</sup>

- **Selection of drugs:**

Generally drug selection in epidemics like Nipah should be based on its **Rasayana** property along with **anti oxidant and antiviral** property, and only then can they show the instant effect<sup>[35]</sup>.

The treatment modalities of Nipah can be categorized into symptom modifiers and

general health promoters. The drugs which improve the Quality of Life and vector control measures will be helpful in the management of Nipah.

A) **Symptoms modifier**- The agents, that alleviate symptoms are categorized under symptom modifier- Jwara hara (anti pyretic)<sup>37</sup>.

B) **General health promoting agents**- Agents that improve Quality of Life, provides strength or resistance against the disease are classified under General Health Promoters- Rasayan (Immunomodulator)<sup>39,40</sup>. Some examples of symptoms modifier are listed below in table 3.

Acharya Yogaratkar has mentioned two decoctions for Sannipat jawar as follow Parpataka, Dhanvayas, Adusa, Bhrustrina, Kutaki and Madayantikaa Decoction with Sugar is useful in sannipatika Jwar. Mustak, Padamakashtha. Parpat, Shwet Chandan, Jati, Shatavari, Yashtinmadhu, Nimba twak, Ushir, Chitrak, Raktachandan decoction with Honey.<sup>40</sup> Drug of Choice: According to Ayurveda when immunity becomes weak, the virus and bacteria can develop and multiply in the body. One's immune system must be boosted so that the body can fight against bacteria and virus and prevent diseases.



**Table 3** Classical Formulations in the Management of Nipah

Health Care Strategies	Definition	Ayurvedic Drugs
Primary Level	Methods to avoid occurrence of disease either by increasing resistance to disease (ojovardhan) or by eliminating disease agents.	<p><b>Symptoms modifier:</b></p> <ul style="list-style-type: none"> <li>• Shadang Paniya -(Charak)</li> <li>• Panchmula sadhit khseerpak (Charak)</li> <li>• Shinshpa dugdha, -(Sushrut)</li> </ul> <p><b>General health promoting agents(Immunomodulator)</b></p> <ul style="list-style-type: none"> <li>• Pippali Vardhman Rasayan- (Charak)</li> <li>• Triphala Rasayan- (Charak)</li> <li>• Herbs-Amalaki,Guduchi, Haritiki, Shankhpushpi, Aswagandha etc.</li> </ul>
Secondary Level	Methods to detect and address on existing disease prior to the appearance of symptoms.	<p><b>Symptoms modifier:</b></p> <ul style="list-style-type: none"> <li>• Rajvrikshadi kwath -(Sushrut)</li> <li>• Nagaradi Kwath -(Sushrut)</li> <li>• Naladi kwath, -(Sushrut)</li> <li>• Haridradi Kwath, -(Sushrut)</li> </ul> <p><b>Immunomodulator:</b></p> <ul style="list-style-type: none"> <li>• Ashwagandadi Avaleha (Charak)</li> <li>• Amlaka Rasayana - (Charak)</li> <li>• Haritaki Rasayan, (Charak)</li> <li>• Dhatri Avleha--(Sushrut)</li> </ul>
Tertiary Level	Methods to reduce negative impact of symptomatic disease	<p><b>Symptoms modifier:</b></p> <ul style="list-style-type: none"> <li>• Brihatyadi kwath, (Charak)</li> <li>• Brihatyadi gana kwath (Charak)</li> <li>• Shatyadi varga kwath- (Charak)</li> </ul> <p><b>Immunomodulator:</b></p> <ul style="list-style-type: none"> <li>• Haridra khand- Ras tantra Saar</li> <li>• Amritotarakashya-Siddh yog sangrah</li> <li>• Samshamani vati –Siddh Yog Sangrah</li> <li>• Indukantha kashaya- Ras tantra Saar</li> </ul>

Along with the above mentioned formulations, medicinal plants like Mustak [*Cyperus rotundus*], Tulsi [*Ocimum sanctum*], Pippali [*Piper longum*], Yashtimadhu [*Glycyrrhiza glabra*], Haridra [*Curcuma longa*], Sunthi [*Zingiber officinalis*] have properties of immunomodulator, improve the body's defense mechanism, thereby increasing its ability to fight viral diseases and also plays a key role to prevent viral and bacterial outbreak.

#### 10.4 Preventive Management (Diet and Life style Modification):

- **Ahara (diet)-**
  1. Avoid eating or buying fruit and vegetables at unhygienic places or fruit fallen on the ground,
  2. Fruits should be washed thoroughly and peeled or cooked properly.
  3. Consume clean and well cooked homemade food till the outbreak settles down.
  4. Avoid unpasteurized juices, always have home made fresh food, plenty of lukewarm liquids, light and warm diet.



- **Vihara (life style)-**
  1. Avoid contact with pigs and pig handlers, bats and horses and avoid visiting the Nipah disease prevalent areas.
  2. Person, who generally comes in contact with potentially infected animals, including laboratory personnel and health-care workers, should wear protective clothing, gloves, masks, and boots.
  3. Maintain personal hygiene.
  4. Patients infected with NiV should be isolated because the virus can be transmitted from person to person.
  5. Preferably use mask while travelling in public places to avoid person to person transmission.

## **DISCUSSION AND CONCLUSION**

A decent number of standards are found in the classical texts of Ayurveda, which can be compared with the concepts of epidemiology, these principles can be analyzed, compiled and interpreted in the light of current modern theories of epidemiology. In the process of theoretical analysis, the concepts are important, such as the concept of causes of epidemic, modes of communicable disease transmission, classification of disease etc.

Ayurveda describes concept of epidemic that can be compared with

Janapadodhwans. Ayurveda summarize the entire relevant concept in single word as Janapadodhwansa Rogas.

The Niv was studied from modern Medical books and from Internet sources. Later the Brihatrayi and other classical Textbooks of Ayurveda were examined regarding the references for different disease conditions and various concepts with respect to disease.

In spite of the fact that most of the herbal formulation fails to prove its efficacy on microbes in experimental studies, however it is observed since ages that they have disease curing activity, which is by the action of these herbs on body's response against disease.

Here it may be illuminated that the modern technologies fails to prove the affectivity of herbal formulations in infective disease. More current trend and technologies in future may prove them effective, yet till that time as Ayurved practitioners; it is required to gather as much clinical evidence to prove effectiveness and safety of ayurvedic medicine in managing NiV. However, being a classical medical doctrine, it has its own appeal that can't precisely be compared with the concepts of epidemiology.

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