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The Crux

BIMONTHLY FORUM FOR THE LABORATORIANS

CONTENTS

Editorial

Fever without a focus is an acute febrile illness in an infant or young child in which the cause is not apparent after a history is obtained and a physical examination is performed. Fever is defined as a rectal temperature that exceeds 38°C (100.4°F). For all patients aged 2-36 months, management decisions are based on the degree of toxicity and the identification of a serious bacterial infection.

During the examination, concentrate on identifying any of the following:

- Toxic appearance, which suggests possible signs of lethargy, poor perfusion, hypoventilation or hyperventilation, or cyanosis (ie, shock)
- A focus of infection that is the apparent cause of the fever
- Minor foci (eg, otitis media, pharyngitis, sinusitis, skin or soft tissue infection)
- Identifiable viral infection
- Petechial or purpuric rashes, often associated with bacteremia
- Purpura, which is associated more often with meningococcemia than is the presence of petechiae alone.

The **DISEASE DIAGNOSIS** segment of this issue talks about **FEVER WITHOUT A FOCUS**, usually in children

ZOONOSIS are an important reason of transmission of animal related infections/ infestations. **TROUBLESHOOTING** section outlines the various ZONNOTIC diseases for you. At a later date we shall take up the matter in ample detail.

Though not very common, **NIPAH VIRUS** has gathered a lot of significance and every now and then it raises its head in the state of Kerala and adjoining Karnataka. We present all related features and presentation with relevant diagnostics and therapeutics related to NIPAH VIRUS under the heading of **UNDERSTANDING**.

Enjoy this issue as we are carrying on fevers that we started in the previous issue.

Do not forget to look at the **BOUQUET** too.

DISEASE DIAGNOSIS

FEVERS WITHOUT A FOCUS

Background

Infants or young children who have a fever with no obvious source of infection present a diagnostic dilemma. Health care professionals commonly evaluate children with fever on a daily basis. As many as 20% of childhood fevers have no apparent cause. A small but significant number of these patients may have a serious bacterial infection; the risk is greatest among febrile infants and children younger than 36 months, making accurate diagnosis and management planning important. Physical examination and patient history do not always identify patients with occult bacteremia or serious bacterial infection. Serious infections that are not recognized promptly and treated appropriately can cause significant morbidity or mortality. This article focuses primarily on infants and young children aged 2-36 months and reflects the significant changes in the care of the febrile infant and child over the past 10 years. The article Fever in the Young Infant addresses the diagnosis and treatment of febrile infants younger than 2 months. Fever is defined as a rectal temperature that exceeds 38°C (100.4°F). Direct the initial evaluation of these patients toward identifying or ruling out serious bacterial infections (SBI), most commonly urinary tract infections. The following questions are important to consider:

- What laboratory studies are indicated for various age ranges?
- Which patients need in-depth evaluation and treatment?
- Which patients need treatment with antibiotics?
- Which patients should be hospitalized?
- Which patients can be sent home safely and what follow-up is appropriate for them?
- Are the diagnosis and treatment modalities for each patient cost-effective?
- What is the potential morbidity associated with testing and treatment?
- What are the parental (and patient) preferences for testing and treatment?

A great deal of time and effort has been spent on research to help identify the febrile infant and young child with a serious bacterial infection. However, evaluation and treatment of febrile infants and young children vary, despite nationally published treatment guidelines. Note also, this article primarily addresses children who are completely immunized, and in particular who have received full Hib and PCV7 vaccine series. Unimmunized children are at higher risk for bacteremia, pneumonia, and other SBIs.

Pathophysiology

Meningitis, pneumonia, urinary tract infection (UTI), and bacteremia are serious etiologies of fever in infants and young children. Neonates' immature immune systems place them at greater risk of systemic infection. Hematogenous spread of infection is most common in this age group or in patients who are immunocompromised or unimmunized. For these same reasons, infants who have a focal bacterial infection have a greater risk of developing metastatic infection or bacteremia.

The following are among the most common bacterial etiologies of serious bacterial infection in this age group:

- *Streptococcus pneumoniae*
- *Streptococcus agalactiae*
- *Neisseria meningitidis*
- *Haemophilus influenzae type b*
- *Listeria monocytogenes*
- *Escherichia coli*

Historically, approximately 2.5-3% of highly febrile children younger than 3 years have occult bacteremia, which is typically caused by *S pneumoniae*. The advent of conjugate pneumococcal vaccine has resulted in a decrease in pneumococcal occult bacteremia and other disease. Viral infections are common in the young child as well; however, exclude serious bacterial infection prior to assuming a viral etiology for the fever.

Etiology

Several common bacteria cause serious bacterial infections, including the following:

- *S pneumoniae: S pneumoniae* is still the leading cause of nearly all common bacterial upper respiratory tract infections (eg, pneumonia, sinusitis, otitis media). This organism is also still the most common cause of meningitis in the United States, despite use of the conjugate pneumococcal vaccine.
- *N meningitidis*
- *H influenzae* type b
- *L monocytogenes*
- *E coli: E coli* is the most common cause of UTIs. Among febrile children with UTIs, 75% have pyelonephritis, with consequences that, if missed, include renal scarring in 27-64% of patients, a 23% risk of hypertension, a 10% risk of renal failure, and a 13% risk of preeclampsia as adults. Approximately 13-15% of end-stage renal disease is believed to be related to undertreated childhood UTIs.
- *Salmonella.*

Prognosis

The prognosis for an appropriately treated patient is excellent.

Morbidity/mortality

Patients with no easily identified source of infection have a small but significant risk of a serious bacterial infection. If not recognized and treated appropriately and promptly, a serious bacterial infection can cause morbidity or mortality.

Complications

Although almost all infants, toddlers, and young children with fever without a focus have benign, viral infections, a small number may have serious bacterial infection, which makes good follow-up all the more important.

Clinical Presentation

History

Obtaining an accurate history from the parent or caregiver is important when assessing fever without a focus; the history obtained should include the following information:

- Fever history: What was child's temperature prior to presentation and how was temperature measured? Consider fever documented at home by a reliable parent or caregiver the same as fever found upon presentation. Accept parental reports of maximum temperature, even if they are afebrile at presentation.
- Fever at presentation: If the physician believes the infant has been excessively bundled, and if a repeat temperature taken 15-30 minutes after unbundling is normal, the infant should be considered afebrile. Always remember that normal or low temperature does not preclude serious, even life-threatening, infectious disease.
- Current level of activity or lethargy
- Activity level prior to fever onset (ie, active, lethargic)
- Current eating and drinking pattern
- Eating and drinking pattern prior to fever onset
- Appearance: Fever sometimes makes a child appear rather ill
- Vomiting or diarrhea
- Ill contacts
- Medical history: Immunocompromised children require more evaluation despite low community bacteremia rates.
- Immunization history (especially recent immunizations)
- Urinary output: Inquire as to the number of wet diapers.

Physical Examination

While performing a complete physical examination, pay particular attention to assessing hydration status and identifying the source of infection. Physical examination of every febrile child should include the following:

Record vital signs as follows:

- Temperature: Rectal temperature is the standard. Temperature obtained via tympanic, axillary, or oral methods may not truly reflect the patient's temperature.
- Pulse rate
- Respiratory rate
- Blood pressure

Measure pulse oximetry levels as follows:

- Pulse oximetry may be a more sensitive predictor of pulmonary infection than respiratory rate in patients of all ages, but especially in infants and young children.
- Pulse oximetry is mandatory for any child with abnormal lung examination findings, respiratory symptoms, or abnormal respiratory rate, although keep in mind that the respiratory rate increases when children are febrile.

Record an accurate weight on every chart:

- All pharmacologic and procedural treatments are based on their weight in kilograms.
- In urgent situations, estimating methods (eg, Broselow tape, weight based on age) may be used.

During the examination, concentrate on identifying any of the following:

- Toxic appearance, which suggests possible signs of lethargy, poor perfusion, hypoventilation or hyperventilation, or cyanosis (ie, shock)
- A focus of infection that is the apparent cause of the fever
- Minor foci (eg, otitis media [OM], pharyngitis, sinusitis, skin or soft tissue infection)
- Identifiable viral infection (eg, bronchiolitis, croup, gingivostomatitis, viral gastroenteritis, varicella, hand-foot-and-mouth disease)
- Petechial or purpuric rashes, often associated with bacteremia
- Purpura, which is associated more often with meningococcemia than is the presence of petechiae alone

For all patients aged 2-36 months, management decisions are based on the degree of toxicity and the identification of serious bacterial infection. The Yale Observation Scale is a reliable method for determining degree of illness. It consists of 6 variables: quality of cry, reaction to parent stimulation, state variation, color, hydration, and response. A score of 10 or less has a 2.7% risk of serious bacterial infection. A score of 16 or greater has a 92% risk of serious bacterial infection. It is important to remember that this scale was validated in the occult bacteremia era, prior to widespread pneumococcal conjugate vaccination. Regarding the height of temperature, Hoberman et al found that 6.5% of patients with a temperature of 39.0°C (102.2°F) or more had a urinary tract infection (UTI) and that white females with that temperature had a 17% incidence of UTI.

Table. Summary of the Yale Observation Scale

Observation Items	1 (Normal)	3 (Moderate Impairment)	5 (Severe Impairment)
Quality of cry	Strong with normal tone or contentment without crying	Whimpering or sobbing	Weak cry, moaning, or high-pitched cry
Reaction to parent stimulation	Brief crying that stops or contentment without crying	Intermittent crying	Continual crying or limited response
Color	Pink	Acrocyanotic or pale extremities	Pale or cyanotic or mottled or ashen
State variation	If awake, stays awake; if asleep, wakes up quickly upon stimulation	Eyes closed briefly while awake or awake with prolonged stimulation	Falls asleep or will not arouse
Hydration	Skin normal, eyes normal, and mucous membranes moist	Skin and eyes normal and mouth slightly dry	Skin doughy or tented, dry mucous membranes, and/or sunken eyes
Response (eg, talk, smile) to social overtures	Smiling or alert (< 2 months)	Briefly smiling or alert briefly (< 2 months)	Unsmiling anxious face or dull, expressionless, or not alert (< 2 months)

Differential Diagnoses

Differential Diagnoses

- Bacteremia
- Croup
- Dehydration
- Diarrhea
- Emergent Management of Acute Otitis Media
- Fever in the Infant and Toddler
- Leukocytosis
- Measles
- Neonatal Sepsis
- Parainfluenza Virus Infections
- Pediatric Aseptic Meningitis
- Pediatric Bacterial Meningitis
- Pediatric Bronchitis
- Pediatric Chickenpox
- Pediatric Pharyngitis
- Pediatric Pneumococcal Bacteremia
- Pediatric Pneumococcal Infections
- Pediatric Pneumonia
- Pediatric Pyelonephritis
- Pediatric Urinary Tract Infection
- Respiratory Syncytial Virus Infection

Workup

Laboratory Studies

Recommended laboratory studies for children with fever without a focus are based on the child's appearance, age, and temperature. Begin intravenous (IV) or intramuscular (IM) antibiotic administration for all infants who appear ill once urine and blood specimens are obtained.

Perform the following for children who do not appear toxic:

- Perform urinalysis (UA) by bladder catheterization and urine culture based on the following criteria: all males younger than 6 months and all uncircumcised males younger than 12 months; all females younger than 24 months and older female children if symptoms suggest a urinary tract infection (UTI).
- Rapid testing for viruses (eg, influenza, respiratory syncytial virus) may be useful to decrease the need for other studies and/or antibiotic therapy. Newer multiplex PCR-based panels are available in many ER and inpatient settings that can detect multiple viruses at once, including RSV, influenza, adenovirus, parainfluenza, metapneumovirus, and rhinovirus.
- Consider obtaining stool for WBC counts and occult blood if diarrhea is present.
- For unimmunized patients, consider performing a CBC count and blood culture in addition to the workup above, regardless of how ill-appearing the patient is.

Perform the following for children who are ill appearing:

- Perform a CBC count with manual differential.
- Obtain blood cultures. Culture specimens should be obtained before antibiotic administration.
- Consider obtaining a chest radiograph. Chest radiography should be performed for patients with a WBC count greater than 20,000/µL.
- Perform UA by bladder catheterization and urine culture based on the following criteria: all males younger than 6 months and all uncircumcised males younger than 12 months; all females younger than 24 months and older female children if symptoms suggest a UTI.
- Obtain CSF and perform studies and culture. Administer antibiotics before performing the lumbar puncture (LP) if any delay is anticipated.

- A study by Martinez et al analyzed the prevalence of bacterial meningitis in infants younger than 90 days with fever without a source. The study found that lumbar puncture was performed in 639 (27.0%) of the 2362 infants with fever without a source and the rate was higher in not well appearing infants (60.9%) and in those ≤21 days old (70.1%). 9 infants ≤21 days old and 5 not well-appearing infants were diagnosed with bacterial meningitis and none of the well-appearing infants were diagnosed.

- Consider obtaining stool for WBCs and guaiac if diarrhea is present.
- Admit these patients for further treatment; pending culture results, administer parenteral antibiotics (see Treatment).
- Rapid testing for viruses (eg, influenza, respiratory syncytial virus, etc.) may be useful to decrease the need for other studies and/or antibiotic therapy. In children, the presence of a systemic viral infection is less likely to have SBI. Viremia may predict absence of SBI.
- The role of measurement of C-reactive protein and procalcitonin in the evaluation of these infants is under investigation.
- However, biomarkers tend to be more helpful if fever has been present at least 12 hours. A systematic review and meta-analysis found that procalcitonin is more specific and had high diagnostic accuracy in detecting invasive bacterial infection in children with fever without an apparent source.

Imaging Studies and Other Tests

Imaging studies

Chest radiography is part of any thorough evaluation of a febrile child. Chest radiography is indicated when the patient has tachypnea, retractions, focal auscultatory findings, or oxygen saturation level on room air of less than 95%. Although viral etiologies are considered the cause of most pediatric pneumonias, establishing a viral or bacterial etiology may be challenging.

Procedures

The following procedures may be included in the workup:

- Bladder catheterization
- Suprapubic aspiration
- Lumbar puncture

Treatment & Management

Medical Care

For children with fever without a focus who appear ill, conduct a complete evaluation to identify occult sources of infection. Follow the evaluation with empiric antibiotic treatment and admit the patient to a hospital for further monitoring and treatment pending culture results. Because children presenting with fever and leukopenia are also a concern, consider leukocytosis and leukopenia in making decisions about empiric antibiotic therapy. According to a study by Gomez et al, isolated leukopenia, especially in children without leukocyturia suggestive of a UTI, may not be a significant risk factor for SBI and viral etiologies may be considered more strongly.

Patients aged 2-36 months may not require admission if they meet the following criteria:

- Patient was healthy prior to onset of fever.
- Patient is fully immunized.
- Patient has no significant risk factors.
- Patient appears nontoxic and otherwise healthy.
- Patient's parents (or caregivers) appear reliable and have access to transportation if the child's symptoms should worsen.

Treatment recommendations for children with fever without a focus are based on the child's appearance, age, and temperature.

For children who do not appear toxic, treatment recommendations are as follows:

- Schedule a follow-up appointment within 24-48 hours and instruct parents to return with the child sooner if the condition worsens.
- Hospital admission is indicated for children whose condition worsens or whose evaluation findings suggest a serious infection.

For children who appear toxic, treatment recommendations are as follows:

- Admit child for further treatment; pending culture results, administer parenteral antibiotics.
- Initially administer ceftriaxone, cefotaxime, or ampicillin/sulbactam (50 mg/kg/dose).

Consultations

The need to consult with specialists depends on the specialty of the physician who initially evaluated the patient and the ultimate source of fever. Typically, general pediatricians easily manage febrile infants on both an inpatient and outpatient follow-up basis.

INTERPRETATION

NIPAH VIRUS

Key facts

- Nipah virus infection in humans causes a range of clinical presentations, from asymptomatic infection (subclinical) to acute respiratory infection and fatal encephalitis.
- The case fatality rate is estimated at 40% to 75%. This rate can vary by outbreak depending on local capabilities for epidemiological surveillance and clinical management.
- Nipah virus can be transmitted to humans from animals (such as bats or pigs), or contaminated foods and can also be transmitted directly from human-to-human.
- Fruit bats of the Pteropodidae family are the natural host of Nipah virus.
- There is no treatment or vaccine available for either people or animals. The primary treatment for humans is supportive care.
- The 2018 annual review of the WHO R&D Blueprint list of priority diseases indicates that there is an urgent need for accelerated research and development for the Nipah virus.

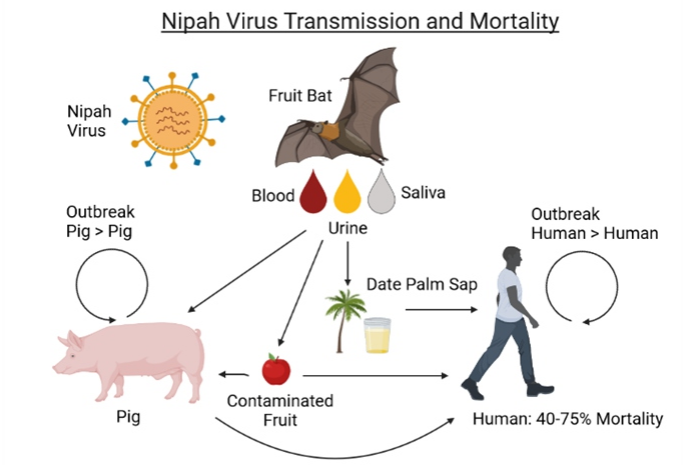
Overview

Nipah virus (NiV) is a zoonotic virus (it is transmitted from animals to humans) and can also be transmitted through contaminated food or directly between people. In infected people, it causes a range of illnesses from asymptomatic (subclinical) infection to acute respiratory illness and fatal encephalitis. The virus can also cause severe disease in animals such as pigs, resulting in significant economic losses for farmers. Although Nipah virus has caused only a few known outbreaks in Asia, it infects a wide range of animals and causes severe disease and death in people, making it a public health concern.

Past Outbreaks

Nipah virus was first recognized in 1999 during an outbreak among pig farmers in, Malaysia. No new outbreaks have been reported in Malaysia since 1999. It was also recognized in Bangladesh in 2001, and nearly annual outbreaks have occurred in that country since. The disease has also been identified periodically in eastern India. Other regions may be at risk for infection, as evidence of the virus has been found in the known natural reservoir (*Pteropus* bat species) and several other bat species in a number of countries, including Cambodia, Ghana, Indonesia, Madagascar, the Philippines, and Thailand.

Transmission

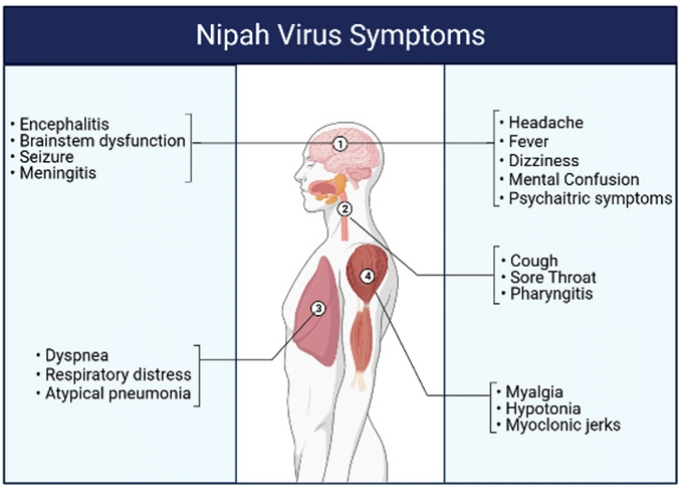


During the first recognized outbreak in Malaysia, which also affected Singapore, most human infections resulted from direct contact with sick pigs or their contaminated tissues. Transmission is thought to have occurred via unprotected exposure to secretions from the pigs, or unprotected contact with the tissue of a sick animal. In subsequent outbreaks in Bangladesh and India, consumption of fruits or fruit products (such as raw date palm juice) contaminated with urine or saliva from infected fruit bats was the most likely source of infection. There are currently no studies on viral persistence in bodily fluids or the environment including fruits. Human-to-human transmission of Nipah virus has also been reported among family and care givers of infected patients. During the later outbreaks in Bangladesh and India, Nipah virus spread directly from human-to-human through close contact with people's secretions and excretions. In Siliguri, India in 2001, transmission of the virus was also reported within a health-care setting, where 75% of cases occurred among hospital staff or visitors. From 2001 to 2008, around half of reported cases in Bangladesh were due to human-to-human transmission through providing care to infected patients.

Signs and symptoms

Human infections range from asymptomatic infection to acute respiratory infection (mild, severe), and fatal encephalitis. Infected people initially develop symptoms including fever, headaches, myalgia (muscle pain), vomiting and sore throat. This can be followed by dizziness, drowsiness, altered consciousness, and neurological signs that indicate acute encephalitis. Some people can also experience atypical pneumonia and severe

respiratory problems, including acute respiratory distress. Encephalitis and seizures occur in severe cases, progressing to coma within 24 to 48 hours. The incubation period (interval from infection to the onset of symptoms) is believed to range from 4 to 14 days. However, an incubation period as long as 45 days has been reported. Most people who survive acute encephalitis make a full recovery, but long term neurologic conditions have been reported in survivors. Approximately 20% of patients are left with residual neurological consequences such as seizure disorder and personality changes. A small number of people who recover subsequently relapse or develop delayed onset encephalitis. The case fatality rate is estimated at 40% to 75%. This rate can vary by outbreak depending on local capabilities for epidemiological surveillance and clinical management.



Diagnosis

Initial signs and symptoms of Nipah virus infection are nonspecific, and the diagnosis is often not suspected at the time of presentation. This can hinder accurate diagnosis and creates challenges in outbreak detection, effective and timely infection control measures, and outbreak response activities. In addition, the quality, quantity, type, timing of clinical sample collection and the time needed to transfer samples to the laboratory can affect the accuracy of laboratory results. Nipah virus infection can be diagnosed with clinical history during the acute and convalescent phase of the disease. The main tests used are real time polymerase chain reaction (RT-PCR) from bodily fluids and antibody detection via enzyme-linked immunosorbent assay (ELISA). Other tests used include polymerase chain reaction (PCR) assay, and virus isolation by cell culture.

Treatment

There are currently no drugs or vaccines specific for Nipah virus infection although WHO has identified Nipah as a priority disease for the WHO Research and Development Blueprint. Intensive supportive care is recommended to treat severe respiratory and neurologic complications.

Natural host: fruit bats

Fruit bats of the family *Pteropodidae* – particularly species belonging to the *Pteropus* genus – are the natural hosts for Nipah virus. There is no apparent disease in fruit bats. It is assumed that the geographic distribution of *Henipaviruses* overlaps with that of *Pteropus* category. This hypothesis was reinforced with the evidence of *Henipavirus* infection in *Pteropus* bats from Australia, Bangladesh, Cambodia, China, India, Indonesia, Madagascar, Malaysia, Papua New Guinea, Thailand and Timor-Leste. African fruit bats of the genus *Eidolon*, family *Pteropodidae*, were found positive for antibodies against Nipah and Hendra viruses, indicating that these viruses might be present within the geographic distribution of *Pteropodidae* bats in Africa.

Nipah virus in domestic animals

Outbreaks of the Nipah virus in pigs and other domestic animals such as horses, goats, sheep, cats and dogs were first reported during the initial Malaysian outbreak in 1999. The virus is highly contagious in pigs. Pigs are infectious during the incubation period, which lasts from 4 to 14 days. An infected pig can exhibit no symptoms, but some develop acute feverish illness, labored breathing, and neurological symptoms such as trembling, twitching and muscle spasms. Generally, mortality is low except in young piglets. These symptoms are not dramatically different from other respiratory and neurological illnesses of pigs. Nipah virus should be suspected if pigs also have an unusual barking cough or if human cases of encephalitis are present.

Prevention

Controlling Nipah virus in pigs, Currently, there are no vaccines available against Nipah virus. Based on the experience gained during the outbreak of Nipah involving pig farms in 1999, routine and thorough cleaning and disinfection of pig farms with appropriate detergents may be effective in preventing infection. If an outbreak is suspected, the animal premises should be quarantined immediately. Culling of infected animals – with close supervision of burial or incineration of carcasses – may be necessary to reduce the risk of transmission to people. Restricting or banning the movement of animals from infected farms to other

areas can reduce the spread of the disease. As Nipah virus outbreaks have involved pigs and/or fruit bats, establishing an animal health/wildlife surveillance system, using a One Health approach, to detect Nipah cases is essential in providing early warning for veterinary and human public health authorities.

Reducing the risk of infection in people

In the absence of a vaccine, the only way to reduce or prevent infection in people is by raising awareness of the risk factors and educating people about the measures they can take to reduce exposure to the Nipah virus.

Public health educational messages should focus on:

- **Reducing the risk of bat-to-human transmission.** Efforts to prevent transmission should first focus on decreasing bat access to date palm sap and other fresh food products. Keeping bats away from sap collection sites with protective coverings (such as bamboo sap skirts) may be helpful. Freshly collected date palm juice should be boiled, and fruits should be thoroughly washed and peeled before consumption. Fruits with sign of bat bites should be discarded.
- **Reducing the risk of animal-to-human transmission.** Gloves and other protective clothing should be worn while handling sick animals or their tissues, and during slaughtering and culling procedures. As much as possible, people should avoid being in contact with infected pigs. In endemic areas, when establishing new pig farms, considerations should be given to presence of fruit bats in the area and in general, pig feed and pig shed should be protected against bats when feasible.
- **Reducing the risk of human-to-human transmission.** Close unprotected physical contact with Nipah virus-infected people should be avoided. Regular hand washing should be carried out after caring for or visiting sick people.

Controlling infection in health-care settings

Health-care workers caring for patients with suspected or confirmed infection, or handling specimens from them, should implement standard infection control precautions at all times. As human-to-human transmission has been reported, in particular in health-care settings, contact and droplet precautions should be used in addition to standard precautions. Airborne precautions may be required in certain circumstances. Samples taken from people and animals with suspected Nipah virus infection should be handled by trained staff working in suitably equipped laboratories.

WHO response

WHO is supporting affected and at risk countries with technical guidance on how to manage outbreaks of Nipah virus and on how to prevent their occurrence. The risk of international transmission via fruits or fruit products (such as raw date palm juice) contaminated with urine or saliva from infected fruit bats can be prevented by washing them thoroughly and peeling them before consumption. Fruit with signs of bat bites should be discarded.

TROUBLESHOOTING

Zoonotic Diseases

Zoonotic diseases are infectious illnesses that spread between animals and humans. Bacteria, parasites, viruses, fungi and prions can cause them. Zoonotic diseases spread through contact with infected body fluids, animal bites, contaminated water and eating infected meat. Bats, livestock, rodents, birds and other vertebrates can carry them.

What are zoonotic diseases?

Zoonotic diseases, or zoonoses, are infectious diseases that can spread between animals (vertebrates) and humans. Vertebrates are animals with a backbone, like cows, sheep, rats, dogs, cats, bats and birds. The way their bodies work is similar enough to ours that pathogens (germs) can sometimes adjust to live in both. Some zoonotic diseases only spread from animals to humans and don't spread from person to person. Others, like Ebola, spread from animals to humans and continue to spread in humans, causing periodic outbreaks of illness. Still others spread to humans and then mutate to only infect humans, like HIV and COVID-19. Once they only spread in humans, they're no longer considered zoonotic (but other forms of the disease can still exist in animals).

Symptoms and Causes

What are the symptoms of zoonotic diseases?

Symptoms of zoonotic diseases vary depending on the specific illness. Some common symptoms include:

- Fever.
- Tiredness (fatigue).
- Headache.
- Body aches.
- Rash.
- Diarrhea.
- Vomiting.

What causes zoonotic diseases?

Many different pathogens can cause zoonoses. These include:

- Bacteria.
- Parasites (protozoa or parasitic worms).
- Viruses.
- Fungi.
- Prions.

Many pathogens only infect one specific type of organism — humans, specific animals, plants or even other germs. But zoonotic diseases have the ability to infect both humans and other vertebrates. Or at one time, they infected only specific animals, but mutations allowed them to "jump" to humans and cause an infection. Most zoonotic illnesses are bacterial, parasitic or viral. Other zoonoses include ringworm (a fungal infection) and variant Creutzfeldt-Jakob disease (vCJD, commonly called "mad cow disease"), a form of prion disease.

Bacterial zoonoses

Bacteria are small, single-celled organisms that often release toxins that can make you sick. Examples of bacterial zoonoses include:

- Anthrax.
- Brucellosis.
- Cat scratch disease.
- Lyme disease.
- Mycoplasma pneumoniae.
- Plague.
- Psittacosis.

- Q fever.
- Salmonella.
- Tularemia.
- Tuberculosis.

Parasitic zoonoses

Parasites can be parasitic worms, protozoa (single-celled organisms) or ectoparasites, like lice and mites. Examples of parasitic zoonoses include:

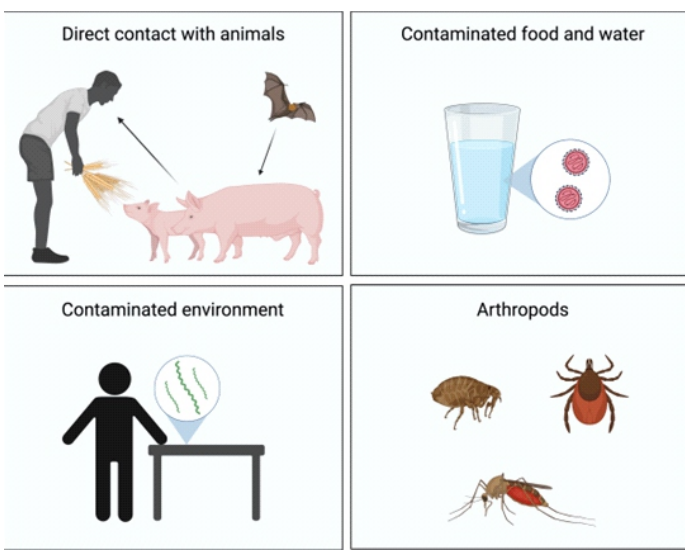
- Cryptosporidiosis.
- Echinococcosis, like hydatid disease.
- Giardiasis
- Liver fluke.
- Malaria.
- Taeniasis (a type of tapeworm you can get from pork or beef).
- Toxoplasmosis.
- Trichinosis.

Viral zoonoses

Viruses are small pieces of genetic information in a container that use our cells to make more copies of themselves. Examples of viral zoonoses include:

- Avian influenza (bird flu).
- Ebola.
- Nipah virus.
- Marburg virus disease.
- Mpox.
- Rabies.

How do you get zoonotic diseases?



Zoonotic illness can spread through:

- Contact with the body fluids (like blood, pee, poop and saliva) of infected animals.
- Bites and sometimes scratches from infected animals.
- Bites from insects, like ticks, mosquitos or fleas.
- Eating undercooked meat.
- Drinking contaminated water (or eating foods washed with contaminated water).

What animals carry zoonotic diseases?

Almost any animal can carry zoonotic illnesses. Examples include:

- Bats.
- Birds.
- Cats.
- Deer.
- Dogs.
- Livestock, like cows, pigs and sheep.
- Non-human primates, like monkeys, apes and chimpanzees.
- Rodents, like rats, mice, moles and voles.

Who is at risk for zoonotic diseases?

You might be at higher risk for zoonotic infections if you:

- Work with animals as part of your job or hobbies (like in a veterinary office or on a farm).
- Hunt, prepare or eat wild animal meat.
- Have a weakened immune system.

Diagnosis and Tests

How are zoonotic diseases diagnosed?

Healthcare providers usually diagnose zoonotic diseases with a sample of tissue or body fluid, including:

- Blood.
- Stool (poop).
- Sputum (mucus coughed up from your lungs).
- Mucus swabbed from your nose or throat.

Depending on your symptoms, you may also need imaging tests, like a chest X-ray or CT scan.

Management and Treatment

How are zoonotic illnesses treated?

Treatment for zoonotic illness depends on the infection. Not all zoonotic diseases have specific medications that get rid of the infection. Treatment might include:

- **Antibiotics**. Providers can treat most bacterial infections with antibiotics, especially if caught early.
- **Antivirals.** Providers can treat some zoonotic viruses with antiviral medications.
- **Antifungals.** Ringworm is easily treated with antifungal creams or lotions.
- **Antiparasitic medications.** Providers can treat most parasitic zoonoses with antiparasitic medications.
- **Monoclonal antibodies.** Providers can treat some hard-to-treat zoonotic diseases, like Ebola, with monoclonal antibodies.

- **Surgery.** Some parasites cause cysts that providers remove with surgery.
- **Vaccination and immune globin.** If an animal with suspected rabies bites or scratches you, your provider doesn't wait for symptoms. They vaccinate you and treat your wound with human rabies immune globulin (HRIG) to prevent an infection.

Prevention

Can you prevent zoonotic diseases?

Ways you can reduce your risk of infection with a zoonotic disease include:

- **Stay up-to-date on vaccinations.** If you're at risk for certain zoonotic illnesses, like mpox, rabies or Ebola, you can get vaccinated to help protect you from infection. Many zoonotic illnesses don't have vaccines.
- **Protect yourself from bug bites.** Wear long sleeves and long pants, use bug spray with DEET, check yourself and your pets for ticks after being outside, and ask your veterinarian how to prevent ticks and fleas on your pets.
- **Wear gloves when handling animals (living or dead).** Never pick up a wild animal with your bare hands. Wash your hands thoroughly after handling animals, even if you wear gloves.
- **Follow safe food prep practices.** Cook meat to safe temperatures. Always wash your hands, surfaces and utensils after preparing food. Don't drink or prepare food with untreated water. Don't drink unpasteurized milk or eat foods made with unpasteurized milk.
- **Avoid contact with infected body fluids.** For some serious illnesses (like Ebola), this means using protective equipment (such as a mask, goggles, apron and gloves) when caring for someone with an infection. Avoid touching any of their body fluids and wash your hands after contact, even if you wear gloves. Avoid contact with anything that may have touched infected body fluids.
- **Don't eat bush meat (the meat of wild animals).**
- **Try to avoid animal bites and scratches.** See a healthcare provider if an animal that could have rabies (usually bats in the U.S.) bites or scratches you.

Outlook / Prognosis

Are zoonotic diseases fatal?

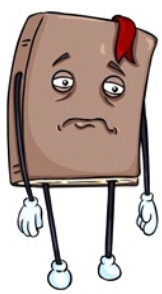
Yes, some zoonotic diseases can be very serious and even fatal. Viral hemorrhagic fevers (like Ebola virus and Marburg virus) have a high mortality (death) rate. Rabies is always fatal once symptoms start. Most other zoonotic illnesses are treatable and are rarely fatal.

BOUQUET

In Lighter Vein

Why couldn't the bicycle stand up by itself?

Why was the math book sad after a long day at work?



Because it had too many problems.

Wisdom Whispers

"If you feel like there's something out there that you're supposed to be doing, if you have a passion for it, then stop wishing and just do it."

❄

"If you can't figure out your purpose, figure out your passion. For your passion will lead you right into your purpose."

❄

"Nothing worthwhile comes easily. Half effort does not produce half results. It produces no results. Work, continuous work and hard work, is the only way to accomplish results that last."

❄

"Talent! There's no such thing as talent. What they call talent is nothing but the capacity for doing continuous hard work in the right way."

Brain Teasers

1. **Lyme disease is an example of a zoonotic disease that spreads from what type of organism?**
a. Tick
b. Leech
c. Snake
d. Mosquito

2. **What is the word used for a disease that people can catch from animals?**
a. Zoonosis
b. Toxicosis
c. Narcosis
d. Halitosis

3. **A pregnant woman with a housecat shouldn't clean the litter box to avoid catching which disease?**
a. Ringworm
b. Rabies
c. Toxoplasmosis
d. Distemper

4. **Nipah is a zoonotic paramyxovirus; where did it originate?**
a. Originating in pigs
b. Originating in bats
c. Coming from humans
d. Coming from horses

ANSWER: 1.A, 2.A, 3.C, 4.A

Diagnosis of fever!

Why Wait?

PyroCHECK™

Integrated test for earliest markers of -
● Malaria ● Dengue ● Typhoid

- **Single integrated test system for Pyrexia** - Detection of Malaria Pf and Pv, Typhoid - IgM and Dengue NS 1 antigen in a single test system.
- **Suitable for complete fever profile test prescription** – Faster treatment decision by clinician.
- **Integrated testing system minimize the procedural and labelling error as single labelling for three tests i.e. Malaria, Dengue and Typhoid** – Easy to handle less test turn-around time.
- **Well suited for point of care testing, as well as pathological lab testing** - Uses whole blood as specimen.

Performance of PyroCHECK™

Diagnostics parameters	Sensitivity %	Overall Specificity %
Malaria *P. Falciparuam* (HRP-2)	100	98.53
Malaria *P. Vivax* (pLDH)	100	
Typhoid (*S. Typhi* IgM)	94	
Dengue (NS1)	98.6	

*Data on file: Tulip Diagnostics (P) Ltd. (Comparison with ELISA)

For Immediate Diagnosis of Fever!

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