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Popular Article

Emerging Porcine Viral Diseases and its Control in India

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Abstract

The Indian pig industry faces a growing challenge from emerging diseases. Emerging viral diseases can devastate pig populations. This article highlights the economic burden of these diseases and the need for effective control measures, including management strategies. Emerging diseases often have no established control measures, making them particularly challenging. Increased biosecurity, farm hygiene, and disease surveillance are essential to prevent outbreaks.

Keywords: Disease, Emerging, Pig, viral

Introduction

An emerging disease is a new disease that is arising in a population or region and whose incidence and geographic range are increasing very rapidly due to lack of diagnostic facility and expertise to control the disease. Many newly developing viral infections have been found in livestock from various parts of India in the last two decades (2000-2020). Among them, the great majority were found to be pig-infectious, which may be the cause of the Indian pig population's decline from 11.13 million in 2007 to 10.29 million in 2012 to 9.06 million in the most recent livestock census of 2019.

Outbreaks of new diseases can cause immense suffering for animals, leading to illness, death, and reduced quality of life. This can not only be a welfare concern but also a production issue, as sick animals are less productive. Livestock diseases can cause devastating economic losses for farmers.

Herds can be decimated, leading to reduction in milk, meat, and egg production. Additionally, restrictions on animal movement and trade can be imposed to control outbreaks, further crippling the industry. Some emerging diseases in livestock can be zoonotic, meaning they can jump from animals to humans. This poses a serious public health risk, with the potential for large-scale outbreaks of human illness. Large-scale animal deaths from disease outbreaks can have a negative impact on the environment. Carcasses can pollute water sources, and mass culling events can disrupt ecosystems.

Factors Contributing to Emerging Disease

The emerging diseases are influenced by a variety of factors that are viral, human and environmental factors.

I. Viral Factors

Mutations: Viruses are constantly mutating, and some of these mutations can make them more transmissible or virulent (able to cause more severe disease).

Antigenic drift: This is a gradual accumulation of mutations in a virus's surface proteins, which can make it less recognizable to the immune system. This can allow the virus to evade existing vaccines and infect previously immune animals. Antigenic drift is a common phenomenon in influenza viruses.

Antigenic shift: This is a more dramatic change in a virus's surface proteins, which can result in the emergence of a completely new viral strain. Antigenic shift is less common than antigenic drift, but it can have more serious consequences. For example, the emergence of the 2009 H1N1 pandemic influenza virus was due to an antigenic shift.

Recombination: This can occur when two different viruses infect the same cell. The viral genomes can then mix and match, creating a new virus with properties of both parent viruses. Recombination is a relatively rare event, but it can be a major driver of viral emergence

II. Human Factors

Population Growth, Urbanization, and Migration

People in developing countries are rapidly moving from rural areas to cities in search of opportunity and employment. Population distribution is shifting worldwide due to urbanization, colonization, labour associated with agriculture, and mining. The rapid migration of people into urban areas and the development of slum areas devoid of proper sanitation, clean water, or shelter may cause large-scale outbreaks of infectious diseases that overwhelm the primary and public health systems. Due to its ability to increase access to necessary healthcare services, urbanization can improve public health. *However, in crowded urban areas without adequate housing and sanitation, infectious diseases spread rapidly due to a lack of proper hygiene practices. In addition, the lack of safe water supplies and sewage disposal systems can result in contaminated water supplies, which are a major*

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contributing factor to emerging infections.

III. *Environmental Factors*

There are several environmental factors that can contribute to the emergence of new diseases in livestock, or the re-emergence of existing diseases. Some of the important ones are:

Climate change: Climate change can alter the distribution and abundance of pathogens and vectors, such as ticks and mosquitoes. It can also make livestock more susceptible to disease by stressing them out with heat, humidity, and extreme weather events.

Land-use change: Deforestation, wetland conversion, and other forms of land-use change can bring livestock into closer contact with wildlife, which can act as reservoirs for pathogens.

Intensification of livestock production: Large, intensive livestock farms can create ideal conditions for the spread of disease. Animals are often housed in close quarters, which makes it easy for pathogens to pass from one animal to another.

Antimicrobial resistance: The overuse of antibiotics in livestock can lead to the development of antimicrobial-resistant bacteria. These bacteria are difficult or impossible to treat with antibiotics, which can make them a serious threat to animal and human health.

Globalization: The global trade of live animals and animal products can increase the risk of disease spread. Animals that are infected with a pathogen may not show any signs of illness, but they can still transmit the disease to other animals when they are transported to a new location.

Emerging Viral Diseases in Pigs

1. African Swine Fever (ASF)

African Swine Fever (ASF) is a devastating and highly contagious disease of pigs and wild boars leading to severe mortality. The disease is marked by haemorrhages and immunosuppression, which cause significant rates of morbidity and mortality in susceptible animals—often exceeding 90–100%. Because of its severe effects and quick spread, the disease is a serious danger to the pig industry worldwide.

ASF is caused by African swine fever virus (ASFV), belonging to the genus *Asfivirus* of family *Asfarviridae*. Each of the continents—Africa, Europe, and Asia—has a distinct pattern for the spread and transmission of ASF. ASF epidemiology is divided into three cycles: sylvatic, tick-pig, and domestic. India has reported the first outbreak of ASF on 21 May 2020 in the domestic pig population in two of the northeastern (NE) states *viz*. Arunachal Pradesh and Assam. Due to its distinct geographic location and shared borders with China, Bhutan, Bangladesh, and Myanmar, the NE states of India is always at risk of transboundary emerging diseases through its porous borders.

The clinical manifestations of ASF can vary, ranging from asymptomatic infections to per

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acute infections (mortality 100%). The incubation period is varying from 4 to 19 days. Acute infection includes a high fever, anorexia, weakness, lethargy, recumbency, diarrhoea, constipation, abdominal pain, haemorrhagic signs, respiratory distress, nasal and conjunctival discharge, and abortions, followed by death within 6–13 days after the onset of symptoms. In young animals, subacute infections manifest clinically as fever, and transient bleeding, which may resolve or cause death in 2-4 weeks. Low mortality rates and clinical symptoms like low or intermittent fever, joint swelling, appetite loss, and depression are linked to chronic infections. These symptoms might appear over a period of 2 to 15 months.

As of right now, no commercial vaccines are available. The only option to stop the spread of infection is to test and cull. The infected sheds and premises need to be disinfected and restocking can be done after 4 months.

2. Porcine Dermatitis Nephropathy Syndrome (PDNS)

Porcine dermatitis and nephropathy syndrome (PDNS) is becoming a global concern for grower pigs. A multisystemic inflammatory disease of pigs seen in growers & finishers (12 to 14 weeks) having mortality rate of up to 50%. PDNS was first described in Assam, Mizoram, Maharashtra, and Chhattisgarh in 2020. It is caused by porcine circovirus type 2 (PCV2) is a member of *Circoviridae* family, genus *Circovirus*. Transmitted by direct contact, contaminated feed, water and equipment. The most noticeable sign, in the acute phase of the disease, is the appearance of skin lesions that are round to irregular, red to purple macules and papules that are coalesce to form large, irregular patches and plaques. The lesions eventually develop dark crusts over them, which eventually disappear (typically in 2 to 3 weeks) and occasionally leave scars. Ears, limbs, dependent areas of the abdomen and thorax, and the perineal region of the hindquarters are among the typical sites. Rarely, multifocal lesions are seen randomly all over the body. Classical renal lesions of fibrinous glomerulonephritis to chronic glomerular sclerosis with interstitial inflammation and fibrosis are present in the affected pigs. While there is no specific vaccine for PDNS itself, good management practices and biosecurity measures can help to reduce the risk.

3. Porcine Astrovirus infections

Porcine astroviruses, or PAstVs, are highly prevalent and have spread around the world. Astroviruses (AstV) of the family *Astroviridae*, are associated with mild to severe gastroenteritis in pigs. It caused significant economic losses in the pig industry due to increased mortality, reduced weight gain, and treatment costs. In India the first case confirmed in Assam (2019), then consequently in Meghalaya, Nagaland, Mizoram, Manipur, Tripura, Uttar Pradesh, Kerala, Karnataka. And Tamil Nadu.

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Transmission of PAstV is thought to be through fecal-oral route. It causes mild, self-limiting secretory diarrhoea. Although the virus affects pigs of less than 2 years of age, the most susceptible period for AstV infection is the finisher stage (6–8 weeks) of pigs. Clinical symptoms may be influenced by co-infections with viruses. To stop swine enteric disease, contaminated premises must be cleaned and disinfected. There should also be standard biosecurity practices.

4. Porcine Rota Viral Diarrhoea

Rotavirus (RV) infections are a prevalent cause of diarrhoea in suckling and weaned pigs in conventional swine herds leading to substantial economic losses to the pork industry. Rotavirus groups A, B, and C are associated with diarrhoea in piglets worldwide. In India, the disease was first reported in 2017. They are transmitted by direct contact. Healthy carrier sows may shed rotavirus in their faeces during the periparturient period, thereby exposing their litters to infection. Rotaviruses, which are persistent in nursery facilities, are frequently exposed to weaned piglets.

Milk scours, white scours, or pre-wean scours are clinical syndromes caused by rotaviral diarrhea, which may occur in suckling pigs soon after birth. Other than supportive therapy, rotaviruses do not have a specific treatment. Rotavirus infections cannot be prevented, but with the right care, their severity can likely be reduced. These include "all in/all out" systems in farrowing and nursery units. Regular and thorough cleaning and disinfection of the premises should be carried out routinely.

5. Post Weaning Multisystemic Wasting Syndrome (PMWS)

PMWS is now recognised as a global, epizootic disease that causes significant economic losses to pig producers caused by Porcine Circovirus (PCV) type 2 virus of the family *Circoviridae*, genus *Circovirus*. During the period 2007–2008 several pig farms in northern Uttar Pradesh and Uttarakhand of north India experienced wasting syndrome with high mortality in post weaned piglets. PMWS most commonly affects pigs of 2 to 5 months of age. Natural infection occurs *via* the oronasal route. Risk factors that trigger a worsening of disease may include, co-infection with PRRSV and porcine parvovirus, mixing of litters, early vaccination against certain diseases and environmental factors, such as poor ventilation, overcrowding, or possible other 'stressors. It is characterised by pyrexia, wasting, dyspnoea and enlarged lymph nodes. Pallor, jaundice (icterus), coughing, gastric ulceration, meningitis, diarrhoea and sudden death may also be seen. There is a high mortality rate in affected piglets most often within 48-72 hours after onset of clinical signs.

As this virus is quite resistant in the environment, hygiene of farrowing rooms is particularly important. An all-in/all-out policy should be strictly applied. Hygiene of the sows as well as an anti-parasitic treatment before entering the farrowing room is advised. Additionally, it's important to keep the temperature suitable and constant avoid combining piglets from various batches, and isolate sick

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pigs as soon as possible.

6. Stillbirth Mummification Embryonic Death Infertility Syndrome (SMEDI)

SMEDI syndrome is most frequently associated with porcine parvovirus 1 (PPV1) infections. PPV1 can infect pigs of all ages, but pregnant sows are especially susceptible because the virus can easily cross the placenta and infect developing foetuses. It is transmitted by direct contact with infected pigs or contaminated materials *viz* faeces, urine, body fluids, ingestion of contaminated feed or water and airborne transmission.

It causes abortion, neonatal death, and decreased male fertility. Initial infection of a herd causes the highest impaction, but losses decrease over time. Because of the infiltration of monocytes, the pregnant sow suffers lesions in the myometrium.

The foetus presents: reduced growth, congestion of superficial vessels that may be associated with haemorrhage and dehydration which results in mummification of the foetus. Vaccination of breeding pigs against PPV1, maintaining a clean and hygienic farm environment, proper disposal of dead piglets and foetal membranes, isolating newly introduced pigs are the ways to prevent the spread of disease.

Control

i. Improving Natural Habitat: It is a very effective strategy to control and even prevent emerging diseases in animals. A healthy environment with abundant resources reduces stress on animal populations. Stressed animals are more susceptible to infections and can shed more pathogens, increasing the risk of spillover to humans or livestock.

ii. Sustainable Livestock Production: It plays a crucial role in both preventing and controlling the emergence of diseases in animals. Strict biosecurity measures like quarantine for new animals, hygiene protocols, and restricted access to farms can significantly reduce the introduction of pathogens. Implementing a proper vaccination schedule for the herd based on local disease risks strengthens animal immunity also helps. Regular health checks, proper nutrition, and stress reduction through good husbandry practices lead to stronger animals less susceptible to infections.

iii. Regulation of International Trade: Regulation of international trade can be a powerful tool in the fight against emerging diseases, but it needs to be implemented strategically along with other measures. Strict regulations on the import and export of animals, plants, and animal products can limit the introduction of pathogens into new regions. Inspections and quarantine procedures at borders can help identify infected individuals or contaminated goods, allowing for quicker containment efforts. Countries with strict disease control measures can encourage trading partners to improve their own practices to maintain access to markets.

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iv. Disease Surveillance: A crucial weapon in the fight against emerging infectious diseases. By proactively monitoring for and detecting new threats, we can significantly improve our ability to control them.

v. Research and Development (R & D**):** R & D plays a vital role in effectively strategizing and controlling emerging diseases. R&D focuses on creating vaccines to prevent infections and rapid diagnostics to identify cases early, enabling prompt isolation and treatment. New drugs and improved personal protective equipment (PPE) are crucial for treating infected animals.

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