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Botulism a Major Risk in Animals After Flood in Pakistan; A Review

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ABSTRACT

Background: *Botulism, a potentially fatal disease, poses an elevated risk to livestock in flood-prone regions like Pakistan. Flooding facilitates the spread of the causative bacteria, leading to substantial losses in the livestock sector. This review delves into the multifaceted aspects of botulism in animals post-flooding.* ***Objectives:*** *To summarize the impacts of botulism on animals post-flooding, covering its epidemiology, transmission routes, symptomatology, and management, based on an exhaustive literature review.* ***Methods:*** *A comprehensive review of literature was conducted, focusing on studies and articles that discussed botulism in animals following flood events. The collected data was analyzed and categorized based on different aspects of the disease, from its transmission to its management.* ***Results:*** *Flooding events, intensified by rapid urbanization, global warming, and other factors, foster the proliferation of spore-forming anaerobic bacteria prevalent in decaying organic matter. Animals, notably cattle, contract botulism either through consumption of toxin-laden rotting substances or endogenous toxin formation. Identified forms of botulism include carrion-associated, toxico-infection, wound, and forage botulism. Symptoms predominantly involve the neuromuscular system, characterized by progressive paralysis, with a high likelihood of resultant death. Treatments are limited in efficacy, making prevention the frontline defense against the disease.* ***Conclusion:*** *Botulism, though not widely acknowledged among dairy farmers, can cause grave losses in livestock populations after floods. The absence of a definitive cure emphasizes the importance of awareness and proactive preventive measures. Dairy farmers should be educated on the risks of botulism and the criticality of early intervention and preventive strategies.*

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INTRODUCTION

Flooding causes a variety of issues, but the most visible ones, such lameness and mastitis, are obvious, so the quality of reaction is typically pretty good. However, there are other less urgent but potentially more severe issues that could arise. Since parasite, worm, coccidia, and fluke problems are more likely to arise after wet circumstances, farmers must be aware of this and prepare for it by strategically watering their crops.

OBJECTIVES: Botulism is the major risk for livestock and human being. The aim of current review article was to know about the effects of botulism on animals, so current review of literature was done.

Animal diseases

Various illnesses including leptospirosis, anthrax, clostridial infections, foot Rot, oedema, mastitis, bovine ephemeral fever, lumpy wool in Sheep, infectious anaemia in horses, botulism, and other vector-borne diseases cause the animal health to suffer following floods [1-2].

Botulism

Among all these mentioned diseases, botulism is the major one which spread in animals after flooding [3-4]. Toxins can be consumed orally and cause intoxication, or they can be created inside the digestive system. The spore-forming anaerobic bacteria thrives in decaying animal tissue, as well as occasionally in plant matter [5-6]. In addition to the outbreak of various bacterial and vector-borne diseases, post-natural catastrophes like floods in underdeveloped countries can result in diseases and infections ranging from epizootics to parasitosis (internal and external). Physical and emotional strain, a lack of wholesome food and drink, environmental damage leading to unsanitary surroundings, etc. are all causes of these post-disaster effects [7-9].

Spread of Botulism in livestock after flood

The population of livestock is the first to be impacted by any unstable condition brought on by a natural disaster, such as an earthquake. Livestock in particular has remained extremely sensitive to practically all types of natural disasters, but flooding is the most common and dangerous of all types [10-11]. The primary cause of floods is the natural ecological system, which includes the monsoons, heavily contaminated river systems, and steep, easily eroded mountains, especially those found in the arctic regions [12]. Other factors cited as contributing to floods include population growth, fast urbanization, severe strain on rural lands, expansion of development in flood plains, and global warming. Decomposing plants and animal carcasses can contain the botulinum toxin after floods. Animals may accidentally eat rotting matter, intentionally if they are hungry or low in phosphorous [13].

Mode of transmission

Toxins can be swallowed accidentally or, in the case of bone chewing, in an effort to gain phosphorus in times of deficiency. Bones, corpses, rotting plants, and silage can all be dangerous. Progressive paralysis brought on by the poison usually results in death. Cattle that have been infected initially may drool and exhibit tongue paralysis. This rapidly worsens into being unable to stand, and in 1 to 2 days, paralysis of the breathing muscles results in death. Mode of action is given in table 1.

Table 1. Production, mode of action and effects of C. botulinum neurotoxins

Feature of neurotoxin	**Effects of *Clostridium botulinum***
Genes which regulate production	Usually in genome
Site of production	In carcasses, Occasionally in wounds or in intestine, decaying vegetation
Mode of action	Inhibition of neuromuscular transmission
Antigen type	Eight antigenically distinct toxins A -G
Clinical effects	Flaccid paralysis

EPIDEMIOLOGY

Occurrence

Clostridium botulinum pathogens are found in soil, rotting and decaying plant matter, and dead bodies all over the world. Geographically, botulism cases are more common in temperate nations than *C. botulinum* does in the soil, and the disease-causing strains are compatible with different types of soil [14].

Etiology

The majority of the time, botulism is an intoxication brought on by ingesting a toxin found in food rather than an illness. A, B, C1, D, E, F, and G are the seven different varieties of *C botulinum*, which are distinguished by the antigenic specificity of the toxins. The most significant types are A, B, and E in humans; C1 in the majority of animal species, particularly in cattle, horses, wild ducks, pheasants, chickens, mink, and D in cattle [15-16].

Source of infection and type of botulism

There are various source of infection and types of botulism. Some are mentioned here in this review of literature.

Carrion Associated Botulism

The best sources of poison are rotting cattle carrion, fly maggots, and bone. There is a significant risk of ingesting BoNT in cattle with pica because they often gnaw on bones and corpses to make up for their mineral deficiencies. When calves consume carrion directly after developing osteophagia from a diet low in phosphorus, this is known as direct carrion consumption. The condition is likely to manifest as an outbreak [16].

Toxico-infection Botulism

Toxico infectious botulism is the term used to describe the illness that C. A living animal's tissue is where botulinum develops and creates toxins. Animals can contract toxico infectious botulism, another type of botulism, by ingesting bacteria from the digestive tract of cattle that are actively developing [16].

Wound Botulism

A illness caused by the expansion of C is wound botulism. In-vivo toxin generation by botulinum spores in a polluted wound. It is a rare acquired neuromuscular junction disorder characterized by descending flaccid paralysis brought on by botulinum neurotoxins (BoNTs) created after *Clostridium votulinum* infection of wounds [15-16].

Forage botulinum

Consumption of food contaminated with which has grown there and produced a toxin, is what causes the sickness. Consuming water or feed that has been polluted by animal corpses and rotting feed has also been documented to cause poisoning [16].

Toxins and sources of *C. botulinum*

The toxins produced by *C. botulinum* which insert bad impacts on livestock health are describes below. Progressive paralysis brought on by the poison usually results in death. Cattle that have been infected initially may drool and exhibit tongue paralysis.

Table 2. Toxins and the source of C. botulinum

Serial number	Toxins	Sources
1	**Type A**	carcasses, meat and toxico infection
2	**Type B**	carcasses, meat and toxico infection
3	**Type C**	maggots, dead invertebrates, rotting vegetation carcasses of poultry, hay or silage contaminated with rodent carcasses and ensiled poultry litter
4	**Type D**	Bones and carcass
5	**Type E**	sludge in earth bottomed ponds, dead invertebrates and fish
6	**Type F**	Fish and meat
7	**Type G**	soil contaminated food

Quinn et al. (2003)

MECHANISM

An anaerobic, Gram positive, spore-forming rod, *C. botulinum* is serious threat for livestock industry after flood. One microgram of the most potent known poisons, botulin, may kill an animal. It causes respiratory and muscular paralysis by obstructing nerve function. In every instance, the toxin produced by *C. botulinum*, not the bacterium itself, is what causes sickness (Arnon *et al.,* 2001).

Casual agents

In cattle, a bacterium called *Clostridium botulinum* causes botulism. The organism, a spore-forming, anaerobic, gram-positive rod, is frequently found in soil samples and aquatic sediments and thrives mostly in decomposing animal and plant materials [17]. The antigenic specificity of the toxins distinguishes the seven different varieties of *C. botulinum*: A, B, C, D, E, F, and G. Types A, B, and E harm people the most; C is the most prevalent in animal species, while D is seen in cattle as given in table 2.

Symptoms or signs of botulinum

There are different symptoms of boyulinum that have reported or showed in livestocks by many researchers. The major signs are given here.

1. Constipation.
2. Drooling of saliva.
3. Decreased tongue tone
4. Issues with prehension of food and deglutition
5. Restlessness
6. Incoordination
7. Stumbling knuckling
8. Ataxia
9. Unable to eat or drink

Botulism symptoms include progressive motor paralysis, altered eyesight, trouble swallowing and chewing, disturbed vision, and progressive paresis. Typically, cardiac or respiratory paralysis results in death [18].

Management or treatment

The antitoxic serum should be either selective or polyvalent since it only works on homologous strains. To eliminate or inactivate toxins in the digestive tract, purgatives, lactic acid administration, and ruminal lavage have all been recommended. Therapy is primarily symptomatic, and you should provide normal nursing care along with hydration and nutritional assistance. Some of the paralysis brought on by the toxin has been successfully treated with guanidine hydrochloride. The best method for preventing botulism is to keep your vaccination schedule current. Supplemental phosphorus may also be helpful [19-22].

CONCLUSION

The aftermath of flooding in Pakistan amplifies the vulnerability of livestock to botulism, a potentially lethal disease often overshadowed by other flood-induced challenges. The disease's ability to rapidly compromise the neuromuscular system in animals, coupled with the absence of a reliable curative measure, underscores the urgency of shifting the focus from reactive responses to proactive preparedness. Addressing the threat of botulism necessitates a multi-faceted approach, centering on heightened awareness among dairy farmers and the wider agricultural community. This includes recognizing early disease indicators, understanding transmission routes, and most crucially, implementing evidence-based preventive measures. As the threat of climate change-induced floods persists, integrated strategies that encompass education, early detection, and preventive action become paramount to safeguard Pakistan's livestock sector against the crippling impacts of botulism.

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