



Bio Vet Innovator Magazine

Volume 2 (Issue 10) OCTOBER 2025



POPULAR ARTICLE

Avian Rabies Infection: A Neglected Piece of the Global Eradication Project

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DOI:

Received: October 17, 2025

Published: October 25, 2025

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Introduction:

If the pathogens of the globe were to be duly enlisted, keeping virulence and mortality into prime consideration, perhaps the deadly Lyssavirus from the family Rhabdoviridae would come up more than once. Strangely enough, this fierce threat to the global One Health movement also holds the infamy of being one of the oldest zoonotic diseases in recorded history. A disease primarily of the warm-blooded mammals, Rabies is responsible for almost 59,000 deaths annually worldwide (WHO, 2017), with 95% of them tracing back to Asia and Africa.

Dogs are critical to the rabies transmission cycle, with up to 99% of the human cases being dog-mediated (WHO, 2024). Thus, widespread efforts are being made to control the dog population for rabies prevention, which sometimes leads to a direct conflict between public interests and animal welfare. Haphazard attempts such as these risk the global 'One Health' movement for short term gains. The concept of 'One Health' describes a collaborative, multisectoral and trans disciplinary approach to achieve optimal health (CDC & OHC, 2017), and a complete eradication of such a deep-seated concern as Rabies is improbable without a holistic approach. Thus, it becomes crucial to raise awareness among the masses about humane control of dog-mediated rabies through Herd Immunity and Animal Birth Control (ABC) programmes, which are scientifically proven to be effective. However, one cannot ensure a true holistic approach without considering the other routes of rabies transmission, and thus, the surveillance for potential emergence of rabies in other species of animals is not an avenue to leave unattended.

Keywords: rabies, one health, herd immunity, zoonosis, food safety, spillover, Negri bodies, fluorescent antibody testing, zero by 30

The Avian Immunity against Rabies:

The avian physiology varies markedly from other species, and that makes them exceptionally resistant to a plethora of infections, including Rabies. A core body temperature of 105-109.4°F (MSD

Veterinary Manual), a range which is significantly higher than that in mammals, creates a hostile environment to the relatively fragile Lyssavirus. Moreover, the non-expression of rabies specific receptors in birds makes it considerably more difficult for street viruses (wild-type) to establish an infection.

An early verification of the avian immunity against rabies came in the year 1884, when the scientific community tried to establish an infection by artificially inoculating the rabies virus in domestic fowls and pigeons (Shannon et al., 1988). The remarkable results revealed that most of the test animals had remained asymptomatic and recovered spontaneously. Further scientific investigations on wild birds, including birds of prey, demonstrated seropositivity of antibodies against the rabies virus and established oral rabies transmission as a potent route in predatory birds & scavengers feeding on rabid prey (Gough and Jorgenson, 1976).

Natural Infection in Birds: A Myth?

Excluding these findings, reports of natural rabies infections in birds were extremely rare, if not absent for the longest time and zoonotic spillover from birds to humans was considered a fanciful idea. But the rabies pathogen is a virus, and perhaps the single deadliest property of viruses is their predisposition to rapid mutations. Viruses, amongst other pathogens, can periodically undergo mutations in their genome in order to attain environmental stability, expand host range, or enhance pathogenicity. The Lyssavirus, being a negative-sense RNA virus, is very unstable in nature, and sudden antigenic shifts should always be accounted for while designing a global elimination project.

The Myth-Buster:

An exceptional scientific report was published in the year 2015 (Baby et al., 2015), with the strange revelation that a domestic fowl (*Gallus domesticus*) in India had suffered mortality due to naturally acquired rabies infection. On preliminary anamnesis, it was affirmed that the bird had suffered a dog bite on its breast muscle a month prior to its death and displayed short-term symptoms of droopiness and inappetence, before finally succumbing to the disease. On further investigation, it was also found that the location from which the case was reported had been highly endemic to canine rabies infections.

The brain of the fowl, the predilection site for the neurotropic Rabies virus, was collected using appropriate necropsy procedure and biosafety protocols. The sample was then dispatched to two independent laboratories, where Fluorescent Antibody Testing (FAT) of the brain revealed rabies antigen. Although impression smears of the brain could not demonstrate Negri Bodies using Seller's staining, a real-time PCR (Polymerase Chain Reaction) confirmed the rabid status of the poultry.

Zoonotic Significance of Avian Rabies:

Therefore, it is evident that rabies is an infection that can affect birds without showing exorbitant clinical signs and disease variations (furious form & dumb form), as seen in mammals. While it is true that birds are relatively resistant to the infection due to multiple innate factors, the true quantification of avian

rabies cases remains a mystery due to under-reporting and diagnostic inadequacies. The communities that are endemic to rabies infections are mostly the underprivileged rural territories in Asia and Africa (Knobel et al., 2005), where diagnostic facilities are primitive at best. This situation, coupled with the already severe stress of dog-mediated rabies, leads to an enigmatic scenario.

If an explanation is to be drawn, it can be inferred that most birds die early after suffering a dog bite due to shock or secondary wound complications, before the clinical signs have time to manifest. Nevertheless, seropositivity and localisation of the rabies antigen in the central nervous system could bear the risk of serious zoonotic spillovers through handling & butchering of infected poultry. This also indicates a grave food safety concern. Moreover, appropriate protocols to be followed in such an exposure are not yet standardised and remain largely a neglected area of research.

Conclusion & Future Outlook:

Avian Rabies is an emerging threat and, if left unchecked, has the potential to become an unpredictable obstacle in the global fight against rabies. Flagship programmes, such as the World Health Organisation's "Zero by 30" vision of ending human deaths from dog-mediated rabies, are viable only when the stakeholders at multiple strata are aware of their respective obligations. The veterinary fraternity plays an immense role in this strategic battle, and we must not let the opportunistic flare-up of Avian Rabies infections replace dog-mediated rabies, as it is slowly eliminated. Therefore, along with current protocols of effective vaccinations, awareness and personnel development, Avian rabies must be duly researched. Development of appropriate pre exposure and post-exposure prophylaxis for birds and humans exposed to rabid poultry would help prioritise our future action plan and provide us with the best chance at an optimal retaliation against the fatal encephalopathy known as Rabies.

Acknowledgement:

I would like to express my sincere gratitude to the scientific community and frontline workers, whose unwavering efforts have been monumental in the global movement against rabies. The author declares no conflicts of interest while preparing this manuscript.

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