

MANAGEMENT OF A CONCURRENT OUTBREAK OF NEWCASTLE DISEASE AND KLEBSIELLA INFECTION IN 70-WEEK-OLD BROWN LAYERS: A CLINICAL CASE REPORT

Stanley David Oziegbe¹, David Olayinka Ishola^{2&3}, Oludotun Olubusola Oladele⁴, George Yilzem Gurumyen⁵

¹Faculty of Veterinary Medicine, Department of Theriogenology and Animal Production, University of Jos, Nigeria

²Postgraduate College of Veterinary Surgeons Nigeria, Abuja, Nigeria.

³Olam Hatcheries Limited, Kaduna, Nigeria, Nigeria.

⁴Faculty of Veterinary Medicine, Department of Medicine, Surgery and Radiology, University of Jos, Nigeria.

⁵Faculty of Veterinary Medicine, Department Microbiology and Patholgy, University of Jos, Nigeria

Corresponding author's details: Phone no: +2347037797279; Email: ishdaveson@gmail.com; ORCID :0000-0003-0785-3869

ABSTRACT

A concurrent outbreak of Newcastle Disease (ND) and *Klebsiella planticola* infection was investigated in a flock of 70-week-old brown layers (n=6,000) raised on deep litter. The farm reported reduced egg production, anorexia, and increased mortality rate, peaking at approximately 0.67% per day (40/6,000). Post-mortem findings included necrosis of caecal tonsils, petechial hemorrhages at the proventricular-gizzard junction, lineal hemorrhages at the colorectal mucosa, and marked hemorrhages on the duodenal mucosa. Other lesions included soft-shelled eggs in the oviduct, pericarditis, and peritonitis. Histopathology revealed severe pulmonary edema, renal hemorrhages, and lymphoid depletion in the spleen. *Klebsiella planticola* was isolated and identified through biochemical tests. It also showed susceptibility to enrofloxacin, which was administered. Mortality dropped significantly, with zero deaths by the fourth day of treatment. A booster dose of ND live Lasota vaccine raised protective ND antibody titers from 43.8% to 100% post-vaccination. Recommendations included strict biosecurity, routine water sanitation, and proper vaccination protocols to prevent future outbreaks.

Keywords: Infectious bronchitis virus, Arbor Acre, Breeder flock, Colibacillosis, Vaccine failure, Poultry health

INTRODUCTION

Commercial poultry production is a significant source of income and employment, particularly in rural economies (World Bank, 2018). However, the sector faces persistent challenges, notably disease outbreaks of infectious and non-infectious origins. Many outbreaks in Nigeria are associated with bacterial pathogens (Barde *et al.*, 2012). Newcastle Disease (ND), caused by avian paramyxovirus serotype 1 (APMV-1), is highly contagious and affects more than 200 bird species (Rauw *et al.*, 2009). It can cause severe economic losses in the poultry industry, with mortality approaching 100% in unprotected flocks (Sharma *et al.*, 2023). The World Organisation for Animal Health (OIE) recognizes ND as a notifiable disease.

Klebsiella pneumoniae is an opportunistic pathogen widely associated with nosocomial infections (Santajit & Indrawattana, 2016). In poultry, it has been linked to pneumonia, airsacculitis, pericarditis, and septicemia (Tantawy *et al.*, 2018). The emergence of hypervirulent and antimicrobial-resistant strains, including *Klebsiella planticola*, poses a dual threat to poultry health and public safety (Wyres & Holt, 2018; Kowalczyk *et al.*, 2022). Biofilm formation enhances survival, persistence, and resistance, contributing to its pathogenic potential (Osland *et al.*, 2020; Nesse & Simm, 2018). This report describes the concurrent outbreak of ND and *K. planticola* in a 70-week-old

commercial layer flock and outlines its clinical presentation, diagnostic findings, and management.

CASE PRESENTATION

On October 2, 2024, a visit was made to a commercial layer farm experiencing increased mortality and reduced egg production. The flock comprised 6,000 brown layers aged 70 weeks, managed on a deep litter system and fed self-milled feed. Water was supplied from a borehole and treated with Aquacure® (sodium dichloroisocyanurate). The farmer reported a daily mortality rate of approximately 0.32–0.35% (19–21/6,000), accompanied by reduced feed intake but sustained water consumption. Egg production had also declined over the preceding five days. Mortality rate peaked at approximately 0.67% (40/6,000) on September 28, 2024. The birds were treated with gentamicin for three days, leading to a temporary reduction in mortality to about seven birds per day, after which deaths began to rise again. Five freshly dead birds were submitted to the Avian Clinic, University of Jos Veterinary Teaching Hospital, Plateau State, Nigeria, for postmortem examination. Tissue samples from the lungs, kidneys, spleen, and liver were collected. Portions of each organ were fixed in 10% neutral buffered formalin for histopathological evaluation, while separate portions from the same organs were used for bacteriological culture and antibiotic susceptibility testing.

Gross lesions observed included marginal cyanosis of the comb, emaciated carcasses, congested breast muscles, streaks of pallor on a friable liver (Plate I), mild pericarditis and peritonitis, regressed ovarian follicles, pallor of the kidneys, mild petechial hemorrhages at the proventricular-gizzard mucosal junction, necrosis of the caecal tonsils, lineal hemorrhages at the colorectal mucosa, congested pancreas, marked hemorrhages on the duodenal mucosa, marked oophoritis with caseous masses in the oviduct (Plate I and II), and slight petechial hemorrhages in the proventricular mucosa (Plate V). Histopathological findings included severe pulmonary edema with cellular infiltration around the parabronchi ((VI), intestine of layer showing severe inflammatory cells infiltration (Plate VII), severe renal hemorrhages with necrosis of tubular epithelial cells, depletion of lymphoid follicles in the spleen, and severe hepatic congestion with edema. Samples from the liver, lungs, kidneys, and spleen were aseptically collected and submitted for bacteriological analysis. Each sample was streaked onto MacConkey agar, blood agar, and nutrient agar, and incubated aerobically at 37 °C for 24 hours. Distinct colonies were purified and subjected to Gram staining and a series of biochemical tests, including catalase, oxidase, indole, methyl red, Voges-Proskauer, citrate utilization, urease, motility, and lactose fermentation, the results were inputted on an online portal for bacterial identification (<https://microrao.com>). The isolates were identified as *Klebsiella planticola* based on their morphological and biochemical characteristics. Antibiotic susceptibility testing was performed using the Kirby-Bauer disc diffusion method on Nutrient agar. The organism was sensitive to streptomycin, penstrep, and enrofloxacin; intermediate to gentamicin, furaltadone, and tylosin; and resistant to colistin and oxytetracycline. Therapeutic management included the administration of 20% enrofloxacin at 15 mg/kg body weight via drinking water for five consecutive days to control secondary bacterial infections. In addition, Viru-supra® was administered at 1 g/L of drinking water for five consecutive days to sanitize drinking water and reduce microbial load. Viru-supra® contains potassium peroxomonosulfate (59%) and sodium dichloro-isocyanurate (10%) as its active ingredients. Following treatment, mortality significantly decreased, reaching zero by the fourth day. A booster dose of live ND Lasota vaccine was administered two weeks later, resulting in serological test showing a 100% ND antibody protection with titres at 1:128 and above compared to an initial 43.8%. Serological test used was Hemagglutination inhibition test.

DISCUSSION

ADVICE TO THE CLIENT

Strict biosecurity measures should be maintained on the farm to prevent disease introduction and spread. In

addition, routine water sanitation should be ensured to minimize the risk of waterborne infections and support overall flock health

DISCUSSION

The concurrent outbreak of Newcastle disease (ND) and *Klebsiella planticola* infection in a commercial layer farm posed significant diagnostic and therapeutic challenges. ND is a highly contagious viral disease that primarily affects the respiratory, gastrointestinal, and nervous systems of poultry, often leading to severe economic losses due to high mortality, decreased egg production, and compromised flock health (Sharma *et al.*, 2023). The presence of characteristic ND lesions in this case, including necrosis of the caecal tonsils, hemorrhages at the proventricular-gizzard junction, and marked hemorrhages on the duodenal mucosa, aligns with previous reports on ND pathology (Kumbish *et al.*, 2019). Additionally, histopathological findings, such as severe pulmonary edema, renal hemorrhages, and lymphoid depletion in the spleen, further support the ND diagnosis. Secondary bacterial infections often complicate ND outbreaks, exacerbating clinical signs and increasing mortality. In this case, *Klebsiella planticola*, an emerging opportunistic pathogen, was isolated from affected birds. *Klebsiella* species have been isolated from poultry, causing severe infections such as pneumonia, yolk sac infections, dermatitis, and septicemia, posing significant risks to both bird health and the potential transmission of antibiotic resistance to humans (Kowalczyk *et al.*, 2022; Wyres & Holt, 2018). The isolation of *Klebsiella planticola* in this outbreak highlights its potential role in complicating viral infections. Bacterial infections can weaken the immune system and create a favorable environment for secondary pathogens, further aggravating disease progression.

The farm initially attempted gentamicin treatment, which led to a temporary decline in mortality, but an eventual resurgence suggested antibiotic resistance or an inadequate treatment period. Antibiotic susceptibility testing confirmed *Klebsiella planticola*'s susceptibility to enrofloxacin, which led to a rapid and sustained reduction in mortality. This finding reinforces the importance of antibiotic susceptibility testing before initiating treatment, as empirical antibiotic use without proper diagnostics can contribute to antimicrobial resistance (Kahin *et al.*, 2024; Mourão *et al.*, 2024). Vaccination is a primary method for controlling Newcastle disease, utilizing both live attenuated and inactivated vaccines. However, the heat sensitivity of live vaccines poses challenges, especially in remote areas of developing countries (Ahmed *et al.*, 2024). The administration of a booster dose of live ND Lasota vaccine resulted in a significant increase in ND antibody titers from 43.8%

to 100% within a week. This underscores the importance of routine vaccination, as inadequate immunity can leave flocks vulnerable to ND outbreaks. Previous studies have shown that ND vaccination failure is often due to improper handling, storage, or administration of vaccines, as well as maternal antibody interference in young birds (Nassif *et al.*, 2023; Hu *et al.*, 2022). The successful control of this outbreak highlights the importance of an integrated approach to disease management. Strict biosecurity

measures, including routine water sanitation, restricted farm access, and proper waste disposal, are essential to prevent disease introduction and spread. Given the increasing reports of antimicrobial-resistant *Klebsiella* strains in poultry farms, it is imperative to implement judicious antibiotic use policies and explore alternative disease control strategies, such as probiotics and competitive exclusion therapies, to reduce reliance on antibiotics.



Plate I: Streaks of pallor on the liver of a layer.

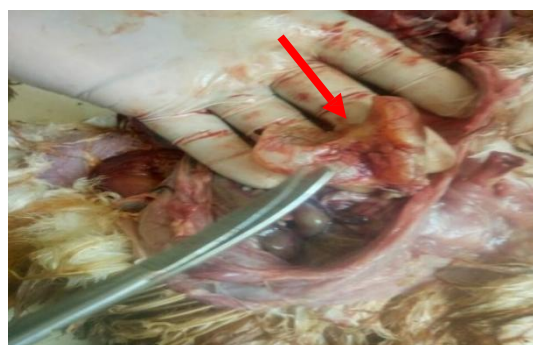


Plate II: Marked oophoritis (Red arrow) in a layer.



Plate III: Caseous mass (red arrow) in the oviduct of a layer.



Plate IV: Slight petechial hemorrhage on the proventricular mucosa (black arrow) of a layer.



Plate V: Frothy, congested and fibrinous lung



Plate VI: Lungs of a layer showing severe edema (asterisk) and cellular infiltration around the parabronchus (arrow). ×10 objective lens magnification, H&E.

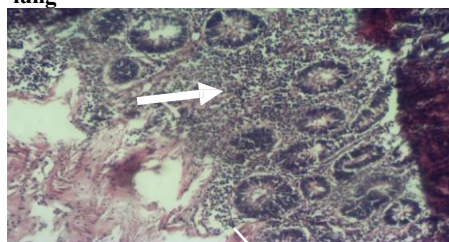


Plate VII: Intestine of layer: Severe inflammatory cenation (white arrow) ×10 Objective lens magnification, H&E

ACKNOWLEDGEMENT

The authors acknowledge the farm management for their cooperation and the diagnostic laboratory staff of the Avian and Fish Clinic of University of Jos Veterinary Teaching Hospital for their technical assistance.

REFERENCES

- Ahmed, R., Das, S., Sharma, A., Deka, P., Nath, M. K., Lahkar, D., Arif, S. A., Brahma, D., & Hazarika, R. (2024). Advancements in Newcastle disease vaccination: Evaluating traditional and thermostable vaccines for enhanced control and efficacy. *Journal of Advances in Biology & Biotechnology*, 27(9), 81–89. <https://doi.org/10.9734/jabb/2024/v27i91276>
- Barde, J. I., Garba, A., Gashua, M. M., Talba, M. A., Gugong, V. T., Sa'adatu, I., Owada, A. H., Konzing, L., Awulu, S. J., & Mohammed, M. N. (2012). Common diseases of poultry in Kaduna State: Perspective of a private clinic. *Nigerian Veterinary Journal*, 33(3), 581–585.
- Hu, Z., He, X., Deng, J., Hu, J., & Liu, X. (2022). Current situation and future direction of Newcastle disease vaccines. *Veterinary Research*, 53(1). <https://doi.org/10.1186/s13567-022-01118-w>
- Kahin, M. A., Mohamed, A. H., Mohomed, A. A., Hassan, M. A., Gebremeskel, H. F., & Kebede, I. A. (2024). Occurrence, antibiotic resistance profiles, and associated risk factors of *Klebsiella pneumoniae* in poultry farms in selected districts of Somalia Regional State, Ethiopia. *BMC Microbiology*, 24. <https://doi.org/10.1186/s12866-024-03298-1>
- Kowalczyk, J., Czokajło, I., Gańko, M., Śmiałek, M., & Koncicki, A. (2022). Identification and antimicrobial resistance in *Klebsiella* spp. isolates from turkeys in Poland between 2019 and 2022. *Animals*, 12(22), 3157. <https://doi.org/10.3390/ani12223157>
- Kumbish, P., Oladele, S. B., Esievo, K. A. N., Giginya, N. D., Ahmed, J., Moses, G., Rimfa, A. G., Choji, T. P. P., Ugbe, A. D., & Anueyiagu, D. M. (2019). Clinico-pathological and immunohistochemistry of Newcastle disease in indigenous chickens and some wild birds in Plateau State, Nigeria. *Journal of Advances in Microbiology*, 16(4), 1–15. <https://doi.org/10.9734/JAMB/2019/V16I430129>
- Mourão, J., Magalhães, M., Ribeiro-Almeida, M., Rebelo, A., Novais, C., Peixe, L., Novais, Â., & Antunes, P. (2024). Decoding *Klebsiella pneumoniae* in poultry chain: Unveiling genetic landscape, antibiotic resistance, and biocide tolerance in non-clinical reservoirs. *bioRxiv*. <https://doi.org/10.1101/2024.01.23.576544>
- Nassif, S. A., Fouad, E., Saber, S. M. A., Abotaleb, M. M., & Mourad, A. (2023). Potential interference of maternally derived antibodies (MDA) of commercial broiler chicks on the efficacy of different vectored-ND vaccines. *Alexandria Journal of Veterinary Sciences*, 77(2), 1. <https://doi.org/10.5455/ajvs.144444>
- Sharma, R., Saran, S., Yadav, A. S., Kumar, S., Verma, M. R., Kumar, D., & Tyagi, J. S. (2023). Economic losses due to Newcastle disease in layers in subtropical India. *Indian Journal of Animal Sciences*. <https://doi.org/10.56093/ijans.v93i5.132229>
- Tantawy, M., Amer, H. A., El-Khyate, F. F., El-Abasy, A., & Moshira, M. (2018). *Klebsiella pneumoniae* infection in broiler chickens. *Kafrelsheikh Veterinary Medical Journal*, 16(1), 17–42. <https://doi.org/10.21608/KVMJ.2018.110203>
- World Bank. (2018). *World Development Indicators*. <https://data.worldbank.org/>
- Wyres, K. L., & Holt, K. E. (2018). *Klebsiella pneumoniae* as a key trafficker of drug resistance genes from environmental to clinically important bacteria. *Current Opinion in Microbiology*, 45, 131–139. <https://doi.org/10.1016/j.mib.2018.04.004>
- World Organisation for Animal Health. (n.d.). Newcastle disease (infection with Newcastle disease virus). Retrieved November 3, 2025, from <https://www.woah.org/en/disease/newcastle-disease/>