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https://dx.doi.org/10.4314/nvj.v43i1.7 **ORIGINAL ARTICLE**

CUTENEOUS AND DIPHTHERITIC FORMS OF AVIAN POX INFECTIONS IN A JUVENILE OSTRICH

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INTRODUCTION

In 2012, the International Committee on Taxonomy of Viruses describes avian pox virus (APV) as morphologically large, complex DNA virus of the subfamily *Chordopoxvirinae* and family *Poxviridae* (Williams *et al.,* 2014). Avian pox virus naturally infects more than 270 of the species of wild and domestic birds (VanderKop, 1993; Bolte *et al.,* 1999). Despite these host species, only ten of the avian pox viruses are well defined (Bolte *et al.,* 1999; Offerman *et al.,* 2013). Relative to avian species infected by this virus, the Avian pox virus APVs were observed to differ in host specificity and virulence (Jarmin *et al*., 2006; Manarolla *et al.,* 2010). The prevalence is significantly high in the tropics and sub-tropics where the control of biting insects is a big issue (Giotis and Skinner, 2018). All ages and species of birds were reported susceptible to direct contact, mechanical, direct ingestion and aerosol transmission of pox virus (Tripathy and Reed, 2003; Ruiz-Martinez *et al*., 2016). Keeping of different species of domestic and feral birds is common in the tropics, but only large scale commercial poultry receive routine pox vaccination (Giotis and Skinner, 2018). Even with this effort, commercial poultry are regularly challenged with infections (Tripathy and Reed, 2003; Giotis and Skinner, 2018). Clinically, the cutaneous or dry form is characterised by discrete nodular proliferative dermal lesions on less or unfeathered regions of the body while the diphtheritic or wet form produces occlusive nodular fibrino-necrotic lesions in the mucus membrane of the upper respiratory tract, oral cavity and esophagus. The later may consequently compromise feeding and respiration resulting in higher mortality rates (Tripathy and Reed, 2003; Bolte *et al.,* 1999; Eo *et al*., 2011). The disease is diagnosed by pock formation on chorioallantoic membranes (CAMs) of specific pathogen free (SPF) embryonated chicken eggs, histopathology is helpful when bolinger bodies are detected, while PCR and electron microscopy confirm virus presence (Williams *et al.,*

2014). Ostriches are very susceptible to avian pox virus infection but few reported cases seem to be documented worldwide (Albwright et al., 1994, Carulei *et al.,* 2017). Vaccination against pox in ostriches is also not a common practice in the tropics despite high risks to avian pox virus infections and increasing ostrich ranches (Albwright et al., 1994, Carulei *et al.,* 2017). This report describes and highlights grave implications of avian pox virus infection in an ostrich which is highly likely to pose a major challenge in ostrich ranches in Zaria, Nigeria.

CASE HISTORY

On the 30th of September, 2018, a juvenile 3-month-old ostrich was presented to the Avian Clinic of the Veterinary Teaching Hospital, Ahmadu Bello University, Zaria with complaints of in appetence, weakness, stunted growth and dark brown crusty irregular nodular lesions on the beak, and in the commissures of the mouth and around the eyes. The ostrich was kept in a fenced environment within the compound together with pigeons and other domestic birds. Similar cutaneous lesions were first noticed in the pigeons few weeks ago before they were later seen on the ostrich. One of the ostrich was reported to have died of similar condition some weeks ago. The ostrich had no any medical or vaccination records. Clinical examination was conducted and revealed pocks lesions on the beak, around the eyes and in the mouth commissures. Whitish diphtheritic and nodular lesions were also observed in the oral cavity and around the pharynx and trachea. The pock and nodular diptheritic lesions were collected, fixed in 10% formalin and sent to the histopathology laboratory.

Histopathology

The skin pock and diphtheritic oral lesions fixed in 10% neutral buffered formalin were dehydrated, embedded in paraffin wax, sectioned at 4 µm size, stained with hematoxylin and eosin (H&E) and examined by light microscopy according to Bancroft and Gamble, (2007).

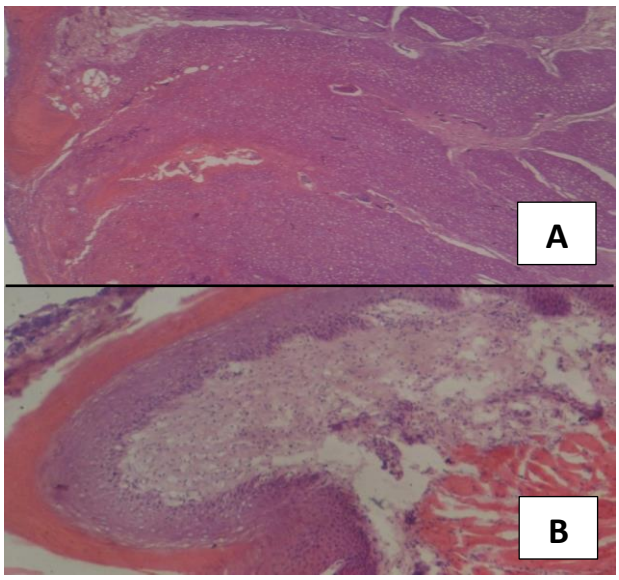

Plate I: A. Photomicrograph of the skin with pox lesions. Note the hyperplasia and hypertrophy of the epidermal cells H & E, X128. B. Photomicrograph of normal skin of turkey for comparison. H & E, X128

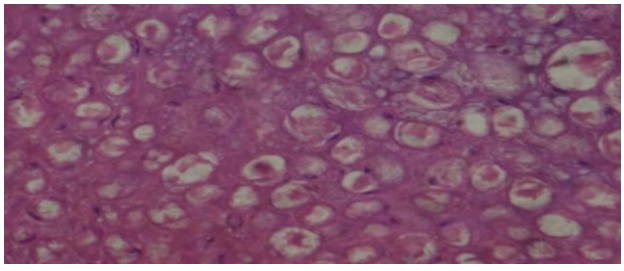

Plate II: Photomicrograph of the skin with pox lesions. Note the hypertrophy of the epidermal cells with eosinophilic intracytoplasmic inclusion bodies H & E stains, X1280.

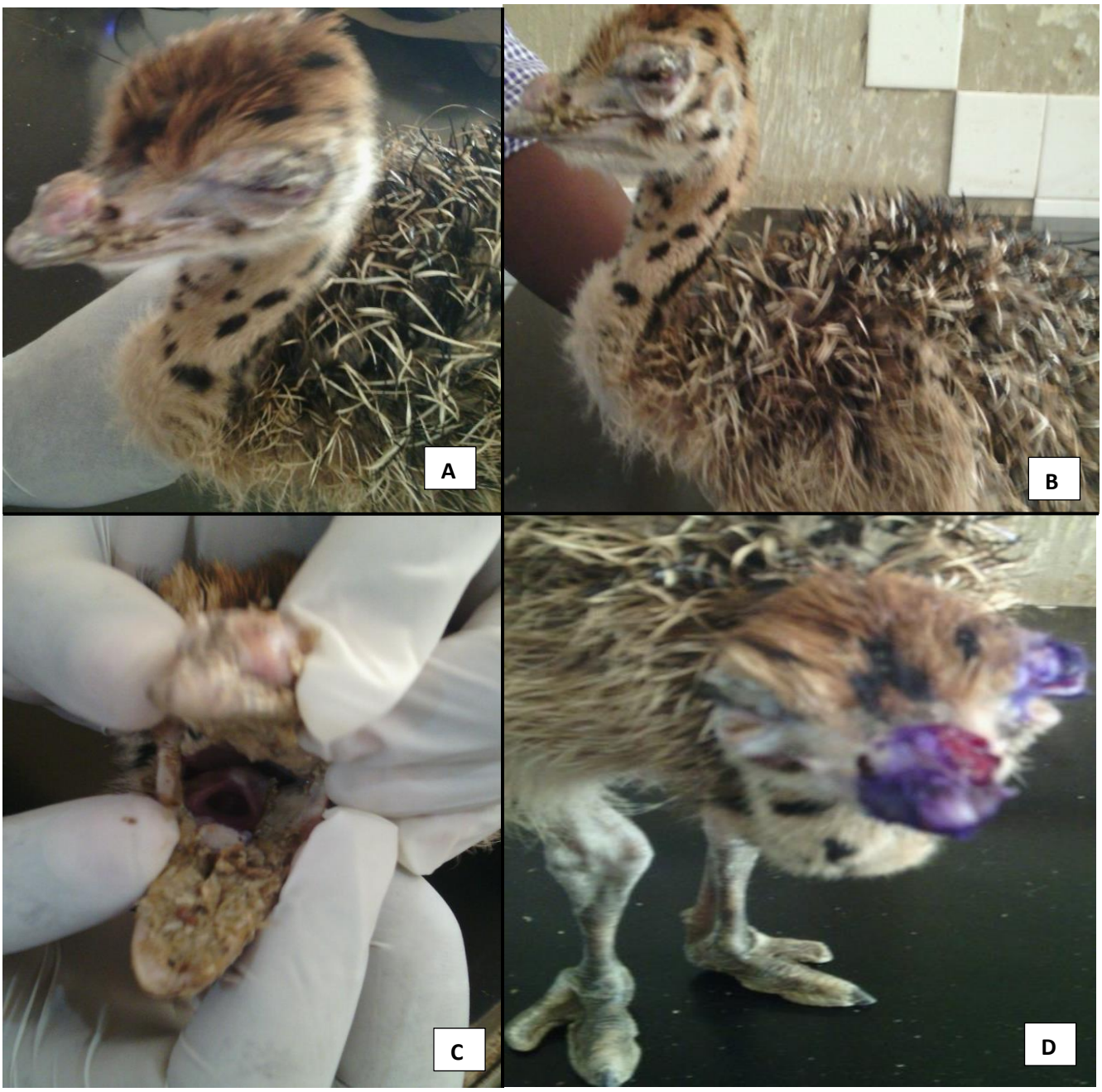

Plate IV: Cutenous pox lesions on the beak (A) and around the eye (B). Diphtheritic white lesions in the oral cavity (arrows, C) and (D) topically applied gentian violet on scarified pox lesions on the beak, around the eyes and mouth commissures of the Ostrich.

MANAGEMENT

Pock lesions were gently scarified and cleaned with diluted (1:10) Purit® (chlorhexidine- Ibadan Nigeria) solution. Oxytet spray® (Gentian violet with oxytetracycline- Kepro, Holland UK) was applied liberally on the lesions. Lesions in the oral cavity were gently removed and mild antiseptic (1:10 diluted potassium permanganate in water) was used to clean the oral cavity. 1 ml of oxynor 20% LA® (Oxytetracycline- Shenzhen, China) injection was administered intramuscularly at the leg muscle once. Vitalyte® (Multivitamins, electrolytes and amino acids (ANUPCO, Suffolk, United Kingdom) was prescribed to be administered at 1gm/litre of drinking water for two weeks.

Advice to the client

Different species of birds should be kept separately. Vaccination against pox in young ostriches should be routinely done using fowl pox vaccines. Also, juvenile ostriches should be kept in insect proof environment.

DISCUSSION

Avian pox is endemic in many tropical countries affecting mainly chickens, turkeys and pigeons (Abdallah and Hassanin, 2013). The number of ostrich ranches are increasing in northern Nigeria but from the available works of literature, reported cases of ostrich pox in Nigeria is very rare, making this report seemingly the first documented cutenous and diphtheritic forms of avian pox in a juvenile ostrich in Zaria Nigeria. However, reports of cutaneous and diphtheritic forms of avian pox in ostriches have long been documented in Israel and South Africa (Albwright *et al*., 1994). Unlike the diphtheritic form, the cutaneous form of the disease is not associated with high mortality although over 35% mortality was reported in ostrich chicks infected with the cutaneous form in South Africa (Albwright *et al*., 1994). Furthermore, reports of APV infection have been documented in an African penguin and a flamingo (Carulei *et al.,* 2017), and turtles (Bolte *et al.,* 1999) indicating its multiple host susceptibility. Despite the multiple hosts affected, only few strains have so far being phylogenetically classified into three major clades as follows: A from fowlpox virus, B from canary pox virus and C from psittacine virus (Jarmin, *et al*. 2006). This case was diagnosed based on clinical signs and histopathology. Avipoxviruses mainly affect the epidermal and mesodermal tissues due to cell proliferation and immune cell responses. Similar diagnostic gross pathology can also be observed in infected chorio-alontoic membrane (CAM) (Offerman *et al.,* 2013) of infected eggs. Typically, oesinophilic intracytoplasmic inclusion bodies (Bollinger's bodies) are usually seen in the histopathological tissue sections (El-Abasy *et al.,* 2016), and are diagnostic of pox infection (Mubarak and Mahmoud, 2000; Manarolla et al., 2010; Williams *et al.,* 2014) as observed in this case. However, inclusion bodies are only present in the first 5 days post infection and readily disappear with advance cellular damage processes (VanderKop, 1993). Reports of natural and experimental infections by El-Abasy *et al.* (2016) and Giotis and Skinner, (2018), showed that infected ostriches were presented with weakness, depression, emaciation, cutaneous and oral lesions, and were stunted in growth as observed in this case. The diphtheritic lesions in the mouth and the

periocular lesions were believed to have affected proper feeding. It was observed that very severe cases of dry pox could also lead to eye closure so that affected bird finds it difficult to feed and eventually starves, while the diphtheritic form produces pseudomembranes in the buccal cavity, pharynx and larynx causing pharyngitis and trachitis thus affecting respiration and feeding (El-Abasy *et al.*, 2016). These were observed in this report. Similarly, the nodular lesions observed in the oral cavity in this case were reported to grow to relatively larger sizes and develop into ulcers or crusty surfaces (Albwright *et al*., 1994). In the management of this case, skin lesions were scarified and antiseptics applied to enhance healing. Parenteral antibiotic was also given to prevent possible secondary bacterial infection. This is because concurrent secondary bacterial systemic infection usually occurs and the course of the disease could hence be protracted in fowl pox infections (El-Gohary, 2002; Deoki *et al.,* 2008). Even though the source and mode of infection in this case were not determined, there have been reports that inhalation or ingestion of droplets or dust containing pox viruses led to more severe infection of the oropharyngeal cavity causing the "diphtheritic or wet pox infection" that resulted to up to 15% mortality in chicken flocks caused mainly by the occlusion of the larynx and or supporting secondary bacterial infections (Giotis and Skinner, 2018). The client was advised to keep juvenile ostriches in insect-proof houses and to always vaccinate young ostrich with fowlpox vaccine as a preventive measure to pox infection. First, pox virus is spread by direct contact (including pecking and scratching), by inhalation or ingestion of dust or aerosols, or mechanically by biting insects. Secondly, it was earlier observed that varying cross protective relationships between avipox viruses exist in many avian species and subsequent prophylactic vaccination of young ostriches was thus recommended. Most importantly, fowl pox vaccine was successfully reported to protect ostriches against pox in high pox risk areas of South Africa (Albwright *et al*., 1994). In Egypt, ostrich pox was reported in many ostrich farms that led to high mortality in juvenile ostriches in which commercial fowl pox vaccine was successfully used to protect other ostriches (El-Abasy *et al*., 2016). However, it is worthy of note that fowl pox vaccines are of two types: those of chicken embryo origin (CEO) and those of tissue culture origin (TCO). The TCO are more attenuated than CEO due to more extensive passage and can be safer used in day-old chicks while the residual pathogenicity associated with CEO vaccines means that they cannot be used until the birds are older. The more attenuated nature of TCO vaccines makes them unable to provide long-lasting protection so much so that layers and breeders would require boosting with CEO vaccine at 6 weeks (Giotis and Skinner, 2018). Unfortunately, it is also evident that in recent years, there has been gradual increase in fowlpox outbreaks in poultry flocks because of an emerging novel type of fowl pox virus. The pathogenicity of this new virus type was believed to have been enhanced by reticuloendotheliosis virus (REV) sequences integrated into various lengths in the FPV genome in vaccine production (CDC, 2014). Consequently, a vaccine break leading to an outbreak of reticuloendotheliasis (RE) was reported after the use of FP vaccine contaminated with REV virus (Zhao *et al.*, 2012). The client was further advised not to mix different species of birds and to always

keep juvenile ostriches in bird and insect-proof houses. It was earlier established that avian pox viruses from one species could infect different bird species (Adams *et al*., 2005; Abdallah and Hassanin, 2013). Perelman *et al.* (1988) successfully produced pox infection in turkeys from pox isolates of ostriches indicating a typical cross species infection. He further used commercial fowl pox vaccine to cross protect other avian species against pox infections thus demonstrating vaccines' cross protectivity. Pox virus infection in ostriches is believed to be transmitted by mosquito bites and commonly occurs when kept in poultry premises. Wild birds could also be a possible source of pox infection to ostriches (El-Abasy *et al.,* 2016).

REFERENCES

ABDALLAH., F.M. and HASSANIN, O. (2013). Detection and molecular characterization of avipoxviruses isolated from different avian species in Egypt. Virus Genes, 46:63-70.

ADAMS, C.J., FELDMAN, S.H. and SLEEMAN, J.M. (2005). Phylogenetic analysis of avian poxviruses among free-ranging birds of Virginia. Avian Diseases, 49, 601605.

ALBWRIGHT, D. M., BURGER, W. P., GEYER, A. and WESSELS, J. (1994). Avian pox in ostriches. Journal of the South African Veterinary Association, 65: 23– 25.

BANCROFT, J. D. and GAMBLE, M. (2007). Theory and Practice of Histological Techniques. 5th Ed. Churchill Livingstone, London, UK, PP: 125-138.

BOLTE, A. L., MEURER, J. and KALETA, E. F. (1999). Avian host spectrum of avipox viruses. Avian Pathology, 28: 415-432.

CARULEI, O., DOUGLASS, N. and WILLIAMSON, A.L. (2017). Comparative analysis of avian poxvirus genomes, including a novel poxvirus from lesser flamingos (Phoenicopterus minor), highlights the lack of conservation of the central region. BMC Genomics, 18, 947.

CENTRE FOR DISEASE CONTROL (CDC) (2014). Emerging Infectious Diseases• www.cdc.gov/eid Vol. 20, No.7, July 2014.

DEOKI, N. T., WILLIAM, M., PARTRICK, J. M. and CARLER, T. A. (2008). Characterization of poxvirus from forest birds in Hawaii. Journal of Wildlife Disease, 36: 225–230.

EL-ABASY, A.M., EL-KHYATE, F.F., ADAYEL, A.S., HEFNY, Y. HEFNY, Y.H. and EL-GOHARY, A.A. (2016). Ostrich pox virus infection in farms at some Northern Egyptian Governorates. Alexandria Journal of Veterinary Sciences, 49 (2): 9-80. www.alexjvs.com DOI: 10.5455/ajvs.227891 ISSN 1110-2047

EL-GOHARY, A. A. (2002). A preliminary report of outbreak of avian pox in Egyptian ostrich farms. Egyptian Veterinary Medical Association, 62: 197-208.

EO, K.Y., KIM, Y.H., and CHO, K.H. (2011). Infection of avian pox virus in oriental turtle- doves. Pakistan Veterinary Journal, 31:354-6.

GIOTIS, S.E. and SKINNER, A.M. (2018): Spotlight on Avian Pathology: Fowlpox virus, Avian Pathology, DOI: 10.1080/03079457.2018.1554893 To link to this article: https://doi.org/10.1080/03079457.2018.1554893

JARMIN, S.A., MANVELL, R., GOUGH, R.E., LAIDLAW, S.M. and SKINNER, M.A. (2006). Retention of 1.2 kbp of 'novel' genomic sequence in two European field isolates and some vaccine strains of Fowlpox virus extends open reading frame FWPV 241. Journal of General Virology, 87:3545–9. http://dx.doi.org/10.1099/vir.0.82373-0

MANAROLLA, G., PISONI, G. and SIRONI, G. (2010). Molecular biological characterization of avian poxvirus strains isolated from different avian Species. Veterinary Microbiology, 140:1-8.

MUBARAK, M. and MAHMOUD, M. (2000). Sequential pathological changes in turkeys experimentally infected with chicken pox virus. Pakistan Veterinary Journal, 20:1-9.

OFFERMAN, K., CARULEI, O., GOUS, A.T., DOUGLASS, N. and WILLIAMSON, A. (2013). Phylogenetic and histological variation in avipoxviruses isolated in South Africa. Journal of General Virology (2013), 94, 2338–2351. DOI 10.1099/vir.0.054049-0

PERELMAN, B., GUR-LAVIE, A. and SAMBERG, Y. (1988). Pox in ostriches. Avian Pathol. 17: 735–739. RUIZ-MARTI´NEZ, J., FERRAGUTI, M. and FIGUEROLA, J. (2016). Prevalence and genetic diversity of avipoxvirus in house sparrows in Spain. PLoS One, 11:1-13.

RUIZ-MARTI´NEZ J, FERRAGUTI M. and FIGUEROLA J. (2016). Prevalence and genetic diversity of Avipoxvirus in House Sparrows in Spain. PLoS One 11:1-13.

TRIPATHY, D. N. and REED, W. M. (2003). Diseases of poultry. In: Saif, Y. M., Barnes, H. J., Glisson, T. R., Fadly, A.M., Mc-Daugold, L. R. and Swayne, D. E. (Eds.), 11th Ed. Ames: Iowa State University Press, Pp. 253 – 269.

VANDERKOP, M.A. (1993). Infectious laryngotracheitis in commercial broiler chickens. Canadian Veterinary Journal, 34:185.

WILLIAMS, R.A., DUCH, E. and PEREZ-TRIS, J. (2014). Polymerase chain reaction detection of avipox and avian papillomavirus in naturally infected wild birds: comparisons of blood, swab and tissue samples, Avian Pathology, 43:130-4.

ZHAO, P., MA, C.T. and DU, Y. (2012). Serological survey of the Reticuloendotheliosis virus infection in China native chicken flocks. Pakistan Veterinary Journal, 32:621-3.