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Case Report

Post-mortem Diagnosis of Management-induced Proventricular Impaction, Rickets, and Tibiotarsal Bone Rotation in a 3-month-Old Ostrich (*Struthio camelus*)

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ABSTRACT

Ostriches are big birds whose growth rate requires adequate nutrition and somewhat clean environments, especially for captive ones. The ostrich and the remaining three members of the herd, which sparingly fed on green spinach (*Spinacia oleracea*) and occasionally, some commercial chicken grower mash, lived in an unkempt environment with no vaccination or medical history. Although there are reports of proventricular impaction, rickets, and tibiotarsal rotation separately in ostriches, their co-existence in an ostrich needs documentation to deepen the current knowledge base concerning its predisposing factors and pathophysiology of the case. A post-mortem examination of a fresh ostrich carcass revealed over-distended proventriculus with considerable amounts of foreign materials, “rachitic rosary” beads in both ribs, and comparatively swollen and angulated or rotated left tibiotarsal bone. These led to a diagnosis of proventricular impaction associated with rickets and tibiotarsal deformity predisposed by poor management practice. Therefore, the prompt and adequate feeding of balanced diets, in the right amount and at the right time, in a cleaner environment would have prevented the development of the conditions in the captive ostrich.

Keywords: *Struthio camelus; Proventricular impaction; Rickets; Tibiotarsal rotation; Diagnosis, Pathology*

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INTRODUCTION

Ostriches are monogastric herbivores that feed on varieties of grass, berries, succulents, seeds, and the leaves of trees and bushes (Mandal et al. 2016) but may sometimes feed on whatever is available, including insects, lizards, snakes, and rodents (Birdlife 2020). Ostriches are highly prone to gastric impaction where too much and too quickly consumption of inedible materials results in stomach impaction, cessation of food and water consumption, and death in acute cases. Although rapid deterioration of the condition and death may occur within a few days in such acute cases, malnutrition, poor feathering and growth rate, and leg abnormalities reportedly occurs in chronic cases (Shanawany and Dingle 1999).

Inadequate vitamin D intake, which is responsible for calcium and phosphorus absorption, may result in rickets or osteomalacia with skeletal and leg deformities in growing ostriches (Shanawany and Dingle 1999). Although the cause and pathogenesis of tibiotarsal rotation in birds are unknown, the condition may be multi-factorial (Hahulski et al. 1999) involving nutrition, strain, housing, sex, exercise, and growth rate (Bezuidenhout et al. 1994). Currently, there are more

reports of tibiotarsal bone rotation in ostriches than cases of rickets (Bezuidenhout et al. 1994; Hahulski et al. 1999; Bello et al. 2017) based on available literature search. However, reports detailing the co-existence of proventricular impaction, rickets, and rotated tibiotarsal bone in ostriches are not readily available hence this present case report. The present work involves a post-mortem investigation of a case of proventricular impaction with rickets and rotated tibiotarsal bone in a 3-month-old ostrich sparingly fed green spinach (*Spinacia oleracea*) and some commercial chicken grower mash occasionally. The report also attempted to elucidate the predisposing factors and the pathophysiology of the condition in the affected ostrich.

CASE DESCRIPTION

A 3-month-old ostrich (*Struthio camelus*), which weighed about 7.5 kg, reportedly suffered a kick on the left hock joint by an older member of the 4-member ostrich herd over the night. The client rushed the affected ostrich to the Poultry Unit

of the Veterinary Teaching Hospital of the University of Abuja, Abuja, Nigeria, upon noticing the condition in the morning but the ostrich died before any veterinary attention. The ostrich, which had no vaccination history reportedly limped around before the incidence and its death. The client also reported that the ostriches sparingly fed on green spinach (*Spinacea oleracea*) and some commercial chicken grower mash (Hybrid Feeds, Kaduna, Nigeria) occasionally. Further inquiry suggested that the ostriches live in an improvised wooden-zinc enclosure within an abandoned unkempt construction compound littered with all kinds of materials.

A post-mortem examination immediately carried out on the fresh carcass, according to standard procedures, revealed the presence of pale mucous membranes and mucous exudates within the nasal passage and the trachea. The over-distended proventriculus contained leafy materials, sand and stones, nails, and broken parts of ceramic tiles with a syringe base and other plastic materials that all weighed about 400 g (Plate 1).



Plate 1
Photograph of the impacting proventricular contents of a 3-month-old ostrich (*Struthio camelus*). Note the sand with some small stones (arrow), nail (N), plastic material (X), syringe base (Z), broken piece of ceramic tile (M), wood stump (S), and leafy fibrous materials (B).

There was a focal paintbrush haemorrhage on the proventricular serosa with focal epicardium and coronary fat petechiae. Similarly, there were “rachitic rosary” beads on both ribs (Plate 2) with congested lungs beside slight hepatomegaly with ecchymotic haemorrhage on the caudal part of the right lobe as well as the presence of renomegaly and splenomegaly with multiple greyish foci. The pancreas showed ecchymotic haemorrhages within it while the duodenum containing blood-tinged mucoid materials had haemorrhagic mucosa. Similarly, a bleeding dislocated left ankle (tibiotarsal/fibula – tarsometatarsal joint) with subcutaneous haemorrhage and a deformed left thigh compared to the right thigh (Plate 3) were present. A 10-day cold-water maceration of the leg bones revealed a rotated left tibiotarsal bone with proximal middle angulation (Plate 4).

DISCUSSION

The pale mucous membranes indicated anaemia, which could have resulted from either the excessive blood loss following the kick or the poor nutrition. Stress arises from their nutritional state or unkempt environment could have triggered the kick as ostriches reportedly respond aggressively to stress

conditions by kicks (Usurelu *et al.* 2015). The over-distended proventriculus with the indigestible foreign materials suggested proventricular impaction that accumulated over time. Stress might have also induced the proventricular impaction as ostriches reportedly eat indigestible foreign materials under stress conditions (Yüksek *et al.* 2002). Although the *S. oleracea* and the commercial chicken grower mash might contain some levels of calcium, phosphorus, vitamin D, and vitamin A, among others, such amounts either might have been insufficient for the growth phase of the ostrich or are in bound and not in readily available forms often associated with plant sources (Garland *et al.* 2008).

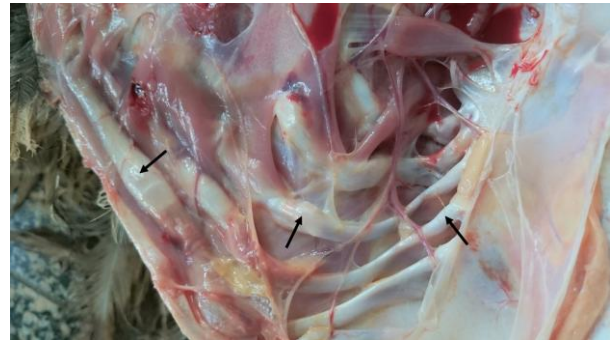


Plate 2
Photograph of the left rib cage of a 3-month-old ostrich (*Struthio camelus*). Note the “rachitic rosary” beading of the ribs (arrows).



Plate 3
Photograph of the limbs of a 3-month-old ostrich (*Struthio camelus*). Note the rotated (arrowhead) and curved (arrow) left thigh with the point of the kick at the hock joint (B) compared to the right thigh and the hock joint (X).



Plate 4
Photograph of the skeleton of the limbs of a 3-month-old ostrich (*Struthio camelus*). Note the rotated left tibiotarsal bone (arrow) with proximal middle angulation (arrowhead) compared to its right counterpart (X).

The fact that the amount of the infrequent feeding of the confined ostriches was unascertainable coupled with the inadequate feeding of unbalanced diets or lack of absorption of any of these vital minerals and vitamins could have predisposed them to stress and the observed complications. Such conditions could cause rickets characterized by “rachitic rosary” beads at the costochondral junctions in affected birds (Bandyopadhyay 2017), as observed in the present case. Although the cause of tibiotarsal rotation in birds is unknown (Hahulski *et al.* 1999), calcium, phosphorus, and vitamin D imbalances have also been fingered among others (Smith 2020). The left tibiotarsal bone rotation and angulation might have caused the observed deformity responsible for the recorded limping, according to Cooper (2007). The observed proventricular impaction, rickets, and tibiotarsal deformity suggested management problems. In addition to separately causing death in some cases (Ogbe *et al.* 2016), some of the conditions like tibiotarsal rotation has reportedly contributed to the development of leg fibroma in an ostrich (Cooper *et al.* 2010)

Although death in the present case is attributable to the prolonged bleeding-induced haemorrhagic hypovolemic shock, poor nutrition and unsanitary environment, among others, was responsible for the observed co-existing proventricular impaction, rickets, and tibiotarsal deformity in the ostrich. Therefore, there is a need to address the observed management flaw to safeguard the growth and survival of the remaining members of the captive herd already denied their natural wild opportunities or privileges.

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