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Case Report

PENDULOUS CROP IN AN ADULT FEMALE TURKEY: CLINICAL PRESENTATION, DIAGNOSIS, AND MANAGEMENT AT UNIVERSITY OF MAIDUGURI VETERINARY TEACHING HOSPITAL, NIGERIA

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ABSTRACT

Pendulous crop is an uncommon yet clinically significant condition in avian species, characterized by the distention of the crop due to fluid and feed accumulation. This report presents the clinical management of a case of pendulous crop in an 11-month-old female Mexican wild turkey (*Meleagris gallopavo*) at the University of Maiduguri Veterinary Teaching Hospital (UMVTH), Nigeria. The turkey, weighing 4 kg and raised in a semi-intensive system, presented with a visibly pendulous crop, reduced food intake, intermittent regurgitation, and weakness over two weeks. Physical examination revealed a distended crop containing fluid and undigested feed. Microbiological analysis identified *Escherichia coli* as the causative pathogen, resistant to oxytetracycline and erythromycin but sensitive to fluoroquinolones and tylosin. Hematological evaluation indicated hypoproteinemia (13.3 mg/dL) and hypoglycemia (4.0 mg/dL), likely due to impaired nutrient absorption.Initial conservative management, including fasting and fluid therapy, failed to resolve the condition, necessitating surgical intervention. An ingluviotomy was performed under general anesthesia to evacuate impacted contents, inspect the crop lining, and repair structural damage. Post-operative care included systemic antibiotic therapy (enrofloxacin), analgesia (piroxicam), topical oxytetracycline spray, glucose supplementation, and wound dressing.The turkey recovered fully within 10 days post-surgery, regaining normal activity without recurrence of clinical signs.This case highlights the importance of an integrated approach, combining diagnostic, surgical, and post-operative strategies, in the successful management of pendulous crop in turkeys. Early intervention and tailored antibiotic therapy are pivotal to recovery.

Keywords: Pendulous crop, turkey, ingluviotomy, *Escherichia coli*, surgical management

INTRODUCTION

The avian crop, a component of the esophagus, exhibits species-specific variations in size and shape (Kierończyk *et al.*, 2016). In poultry, the crop primarily serves as a temporary food reservoir and initiates feed digestion by moistening it and activating enzymes (Classen *et al.*, 2016; Kierończyk *et al.*, 2016). Research indicates that 30-50% of ingested feed enters the crop before reaching the proventriculus-gizzard, and it can remain there for up to 9 hours in turkeys (Classen *et al.*, 2016). Additionally, the crop is believed to contribute to digestive tract health and reduce foodborne pathogen contamination (Cutler *et al.*, 2005; Classen *et al.*, 2016; Kierończyk *et al.*, 2016). Factors like genetics, bird age, nutrition, and flock management can influence crop function (Classen *et al.*, 2016; Kierończyk *et al.*, 2016; Gonder, 2018; Crespo, 2020).

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Pendulous crop (PC) syndrome, also known as crop stasis or crop impaction, is characterized by a loss of muscle tone and crop distention with food and fluids, causing it to prolapse beyond its support structures, resulting in an abnormally large and sagging appearance (Ebling *et al.*, 2015; Çelik & Kıvanç, 2020; Crespo, 2020). This condition disrupts normal crop function and, unfortunately, cannot be detected early or treated effectively, resulting in permanent malposition of the crop (Abdalla *et al.*, 2022). Avian species, including turkeys, broiler chickens and quails, have been reported to be susceptible to this condition (Ebling *et al.*, 2015; Venkatasivakumar *et al.*, 2016; Gonder, 2018), which can arise from various causes, including dietary factors, underlying diseases, and management practices.

Birds with PC continue to eat, but the flow of feed from the crop to the proventriculus-gizzard is compromised due to weakened muscle function (Ebling *et al.*, 2015; Crespo, 2020). This can lead to poor digestion and absorption of nutrients, crop lining ulcers, and eventually, emaciation and mortality (Crespo, 2020). Furthermore, birds with PC may be rejected at processing facilities due to the risk of cross-contamination (Crespo, 2020). Consequently, the primary approach is to euthanize birds with PC to prevent reduced bird well-being and financial losses attributed to decreased feed efficiency and condemned carcasses. Despite appearing normal in live weight, birds with PC generally yield significantly lower carcass weights (Ebling *et al.*, 2015). Therefore, PC poses a substantial challenge in poultry production, impacting both production and animal welfare.

A recent survey in Canada found that 25% of farmers cited PC as a reason for culling turkeys on their farms (van Staaveren *et al.*, 2020). The incidence of PC among flocks of domesticated birds, including turkeys in Nigeria, ranged from 5% to 10%, with higher rates reported in turkeys compared to chickens in earlier studies (Qasim *et al*., 2015). However, other similar studies have reported a prevalence of less than 5% in turkeys, depending on genetic lines, sex, and management practices (Quinton *et al*., 2011; Vermette *et al*., 2016). Although the exact etiology remains unclear, the origin of PC has long been associated with genetic factors (Willems *et al*., 2014). While genetic selection has proven effective in reducing susceptibility to infections in poultry, such as Marek's disease, avian leucosis viruses, salmonellosis, and colibacillosis (Kuhnlein *et al.*, 2003), limited efforts have been made to reduce susceptibility to non-infectious conditions like PC in turkeys. Previous studies have reported heritability estimates for PC incidence in turkeys ranging from 0.11 to 0.15 (Quinton *et al.*, 2011; Willems *et al.*, 2014), suggesting genetic variability in PC susceptibility. Hence, implementing genetic selection could potentially mitigate PC occurrence, enhancing turkey welfare, and curbing economic losses for breeders and producers. Recent advancements in selection programs, incorporating genomic data, have demonstrated success in enhancing selection accuracy for various turkey traits (Abdalla *et al.*, 2021, 2022).

This case report presents a comprehensive overview of the clinical presentation, diagnosis, and management of pendulous crop in an adult female turkey at University of Maiduguri Veterinary Teaching Hospital, (UMVTH), Borno State, Nigeria.

CASE PRESENTATION

An 11-month-old female Mexican wild turkey (*Meleagris gallopavo*), weighing 4 kg, was presented to the Avian Clinic, UMVTH (Figure I), with a history of reduced food intake, intermittent regurgitation, and the presence of a visibly enlarged cervical protrusion over the past two weeks. The turkey was part of a flock of nine birds raised under a semi-intensive management system and fed with commercial grower's mesh. Notably, no other flock mates exhibited similar clinical signs.

PHYSICAL EXAMINATION FINDINGS

During the physical examination, the crop appeared visibly pendulous and distended, extending beyond its typical anatomical boundaries (Figure I). Palpation revealed the crop was excessively full and soft, indicating fluid and undigested feed retention. The turkey displayed signs of discomfort, lethargy, and occasional regurgitation. Additionally, foul-smelling fluid emanated from the buccal cavity, and the bird exhibited weakness and inappetence.

CLINICAL DATA

The cloacal temperature of the patient was 41.2°C, which is considered within the normal range for turkeys. Other vital parameters, such as respiratory and heart rates, were not measured at the time of presentation due to the unavailability of appropriate field equipment. This is noted as a limitation in this case report. However, the capillary refill time was less than two seconds, and the mucous membranes appeared pale pink. The bird was alert, responsive, and clinically stable during the examination. No abnormalities were detected in the musculoskeletal or neurological systems. Thoracic auscultation revealed no abnormal respiratory or cardiac sounds. The remaining birds in the flock did not exhibit similar clinical signs at the time of assessment.

DIFFERENTIAL DIAGNOSIS

The clinical signs observed in the patient, namely, marked crop distention, sagging of the crop below the thoracic inlet, delayed crop emptying, and fluid accumulation were suggestive of several crop dysfunctions. The foremost differential diagnosis was pendulous crop, which is

characterized by either anatomical abnormalities (such as laxity or overstretching of the crop musculature) or functional failure of the crop's motility, often leading to the accumulation of ingesta and fluid.

This diagnosis was supported by the persistent and progressive nature of the crop enlargement, the sagging appearance, and the presence of foul-smelling fluid content upon palpation and aspiration.

Another differential considered was crop stasis (commonly referred to as sour crop), which typically results from secondary bacterial or fungal infections (notably *Candida albicans*) following delayed emptying due to primary crop motility dysfunction. Although the clinical presentation was somewhat consistent, the absence of thickened crop walls, white plaques in the oral cavity or crop, or foul cheesy content made this diagnosis less likely in this case.

Foreign body impaction was also considered; however, the fluid nature of the crop contents and the absence of palpable solid masses during physical examination reduced the likelihood of this being the primary issue. Furthermore, there was no history of the bird accessing materials typically associated with impaction, such as string or synthetic fibers.

DIAGNOSTIC APPROACH

To establish a definitive diagnosis, a combination of clinical examination and supportive diagnostic procedures was employed. Physical examination revealed a markedly distended, sagging crop filled with undigested feed material, which was associated with signs of discomfort. Blood samples were collected for hematological analysis to evaluate the presence of systemic infection or inflammation. Additionally, crop content was obtained and submitted for microbiological evaluation to detect potential secondary infections. The clinical signs, along with the diagnostic findings, supported a diagnosis of pendulous crop.

DIAGNOSIS

The diagnosis of pendulous crop in the adult female turkey was primarily clinical and based on a combination of historical and physical examination findings. The bird presented with a visibly enlarged, distended crop hanging loosely from the neck region, which had persisted over time, along with signs of delayed emptying and regurgitation. On physical examination, the crop was markedly distended, soft, and fluid-filled on palpation, suggesting functional impairment and retention of ingesta. These features are characteristic of pendulous crop, as previously described in avian clinical cases.

While imaging techniques such as radiography or contrast cropography are typically recommended to confirm the diagnosis, identify structural abnormalities, or rule out crop impaction, such facilities were not available at the time of diagnosis. In resource-limited settings like ours, a combination of history, palpation, and observation of crop filling and emptying patterns remains a reliable approach for presumptive diagnosis of pendulous crop, particularly when findings are consistent with documented clinical presentations in turkeys and other poultry species.

MANAGEMENT

Non-surgical management was initially employed, consisting of fasting to promote the emptying of the crop, fluid therapy to address dehydration, and analgesics for pain relief. However, despite these measure, the crop remained distended, necessitating surgical correction.

PRE-SURGICAL PREPARATIONS

The surgical correction of the pendulous crop began with the careful de-feathering of the area surrounding the crop to expose the surgical site (Figure II). To ensure a sterile field, the exposed skin was thoroughly scrubbed with 10% povidone-iodine solution (Betadine®, Aviro Health Care Ltd., Nigeria), followed by rinsing with sterile normal saline and a final application of 70% isopropyl alcohol. Sterile surgical drapes were then applied around the site (Figure IV) to maintain asepsis and minimize contamination.

Local anesthesia was achieved through a ring block around the surgical site using 2% lidocaine hydrochloride injection (Lidocaine®, Jiangsu Hengrui Medicine Co., Ltd., China). A total of 2 mL was administered subcutaneously in a circumferential pattern around the area (Figure III) to provide effective pain control throughout the procedure. These pre-surgical protocols ensured the turkey was adequately anesthetized and the surgical field remained sterile throughout the operation.

LABORATORY FINDINGS: HAEMATOLOGY

Hematological evaluation of the adult female turkey diagnosed with pendulous crop revealed significant deviations from the established reference values for several key parameters. The packed cell volume (PCV) was 37%, which falls within the normal reference range of 22–55% for turkeys. This indicates that the turkey did not present with anemia or dehydration, commonly associated with chronic gastrointestinal disturbances.

However, the protein concentration was markedly reduced at 13.3 mg/dl (mmol/L), compared to the reference range of 200–500 mg/dl. This hypoproteinemia could suggest protein malabsorption or loss, potentially associated with prolonged feed retention in the crop, which is characteristic of pendulous crop conditions. The reduced protein levels are clinically significant as they may contribute to systemic weakness and impaired immune function in the affected bird.

The glucose level was recorded at 4.0 mg/dl, below the reference range of 4.9–7.6 mg/dl. Hypoglycemia in this case may reflect inadequate nutrient absorption resulting from delayed gastric emptying and chronic stasis in the crop.

SURGICAL INTERVENTION

The surgical correction (ingluviotomy) was performed following a ring block using 2% lidocaine hydrochloride (Lidocaine®, Jiangsu Hengrui Medicine Co., Ltd., China) to provide local anesthesia and desensitization. To ensure complete immobilization and analgesia, general anesthesia was also induced using intramuscular injection of ketamine hydrochloride (Ketamine 50 mg/mL, Rotexmedica®, Germany) at a dose of 20 mg/kg and xylazine hydrochloride (Xylazine 20 mg/mL, Sedazine®, Ilium, Australia) at 1 mg/kg.

A longitudinal incision was made on the ventromedial aspect of the crop, approximately midway between the thoracic inlet and the thoracic sternum, over the most distended portion of the crop. Upon entry into the crop lumen, the impacted ingesta was manually evacuated. The crop was then lavaged thoroughly with warm sterile normal saline (0.9% NaCl) to remove residual debris and inspect the mucosal lining for any structural damage, ulcers, or necrosis, none of which were observed.

While evacuation and lavage were effectively performed, it is important to note that these alone may not sufficiently address the underlying structural defect associated with pendulous crop. Therefore, during closure, a reconstructive approach was employed to reduce the crop's volume and prevent excessive ventral pooling of ingesta. This was achieved by carefully apposing the edges during the two-layer suturing process, ensuring tension and anatomical repositioning to restore the crop's functional integrity.

Closure of the crop was done using a two-layer suturing technique. The inner mucosal layer was closed using a simple continuous suture pattern with 4-0 polyglycolic acid (Dexon®, Covidien, USA), while the outer muscular and skin layer was closed using a Ford interlocking pattern with 3-0 nylon (Ethilon®, Ethicon, USA) (Figure V – VIII). This reconstructive approach aimed to minimize the risk of recurrence by restoring the crop's anatomical contour and functionality.

MICROBIOLOGICAL ANALYSIS

A microbiological culture was conducted to ascertain the presence of potential pathogens contributing to the condition. The crop sample was inoculated onto Eosin Methylene Blue (EMB) agar, a selective and differential medium for the isolation of gram-negative bacteria.

Escherichia coli (*E. coli*) was successfully isolated, confirming its role in the etiology of the condition. Colonies appeared as metallic green sheen characteristic of *E. coli*, suggesting a significant bacterial load in the crop content.

ANTIBIOGRAM

The antibiogram analysis determined the antibiotic susceptibility profile of the isolated *E. coli*. The results showed that the bacteria were sensitive to Ciprofloxacin, Enrofloxacin, and Tylosin, indicating that these fluoroquinolones and macrolides would be effective therapeutic agents for managing the infection. Conversely, the bacteria were resistant to Oxytetracycline and Erythromycin, suggesting these antibiotics are not recommended for treatment due to the resistance exhibited by the isolate.

POST-OPERATIVE MEDICATION

A meticulously selected post-operative medication protocol was implemented to ensure infection control, pain relief, and optimal healing. The treatment plan involved administering both systemic and topical medications as follows:

1. ANALGESIA FOR PAIN MANAGEMENT

Piroxicam (20 mg/mL):As a non-steroidal anti-inflammatory drug (NSAID), piroxicam was employed to mitigate post-operative pain and inflammation. The prescribed dose was 0.5 mg/kg body weight, translating to 0.1 mL for the patient. Administered intramuscularly (IM) once daily for three consecutive days (Days 1–3).

2. SYSTEMIC ANTIBIOTIC THERAPY

To prevent or manage potential secondary bacterial infections, Enrofloxacin (Baytril® 10%, manufactured by Bayer Animal Health GmbH, Germany), a broad-spectrum antibiotic from the fluoroquinolone class, was selected due to its efficacy in poultry bacterial infections. The standard dosage of 10 mg/kg body weight was employed. Given that the turkey weighed 4 kg, a calculated dose of 40 mg (equivalent to 0.4 mL of the 100 mg/mL formulation) was administered intramuscularly (IM) once daily for three consecutive days (Days 1–3).

3. **POST-OPERATIVE MANAGEMENT AND TOPICAL ANTIBIOTIC APPLICATION**

Following the surgical correction of the pendulous crop, a topical oxytetracycline aerosol spray (Oxytetracycline aerosol spray, Kepro B.V., Holland) was applied directly to the surgical site to provide localized antimicrobial coverage and minimize the risk of wound contamination. The surgical site was subsequently cleaned and dressed daily under strict aseptic conditions using standard antiseptic protocols. The topical antibiotic was applied once daily for three consecutive days (post-operative Days 1–3).

In addition to local wound care, supportive therapy was administered to address possible dehydration and energy deficits commonly associated with surgical recovery. Specifically, 20 g of glucose was dissolved in the turkey's drinking water and offered over a seven-day period to ensure adequate energy supply, maintain hydration, and support the bird's metabolic demands during convalescence.

The turkey was closely monitored throughout the post-operative period for signs of infection, delayed wound healing, or other complications. This comprehensive post-operative management protocol facilitated an uneventful recovery and maintained an infection-free surgical site.

PROGNOSIS

The prognosis for the 11-month-old female turkey is favorable, given the successful surgical correction, effective infection control, and provision of appropriate postoperative supportive care. The surgical intervention included not only the evacuation and lavage of the impacted crop contents but also a reconstructive procedure aimed at reducing the crop's volume and restoring its anatomical contour. This approach was strategically implemented to minimize excessive ventral pooling of ingesta, which is a common predisposing factor for recurrence of pendulous crop.

The reconstructive closure, achieved through a tension-apposed two-layer suturing technique, enhances the likelihood of sustained functional recovery by reinforcing the structural integrity of the crop. Consequently, the bird is expected to make a full recovery and return to normal feeding behavior and overall health, as evidenced by the favorable postoperative outcome (Figures IX and X). Nonetheless, continued monitoring and improvement of flock management practices remain essential to prevent recurrence and to address potential underlying causes such as dietary imbalances, water intake issues, or crop motility dysfunctions in other flock members.

Figure I: Adult female turkey showing a visibly distended and sagging crop (red ring) at initial presentation

Figure II: De-feathering of the surgical site in the patient showing a clearly distended and pendulous crop

Figure III: Administration of a ring block using 2% lignocaine in the patient

Figure IV: Draping of the surgical site prior to crop surgery in the patient

Figure V: Stab incision procedure using surgical blade and groove director

Figure VI: Pendulous crop of the patient showing engorged blood vessels (black arrow) after surgical incision through the skin. The crop is exposed, revealing vascular congestion prior to cropotomy

Figure VII: Drained pasty crop content (approximately 300 mL) following cropotomy

Figure VIII: Post-operative image showing the sutured skin over the crop region

Figure IX: Surgical wound healing observed 10 days post-operation

Figure X: The recovered adult female turkey reintegrated into the flock and exhibiting normal social and reproductive behavior

DISCUSSION

Pendulous crop, a condition characterized by the distension and dysfunction of the crop, is a relatively uncommon ailment in turkeys but has been documented in other avian species, including chickens, quails, pigeons, and parrots (Çelik & Kıvanç, 2020; Crespo, 2020; Laku *et al*., 2021; Abdalla *et al*., 2022). This case of pendulous crop in an 11-month-old Mexican wild turkey provides valuable insights into the clinical presentation, diagnostic approach, and management of this condition.

The clinical history and physical examination findings in the present case—characterized by reduced feed intake, regurgitation, and a visibly distended crop—are consistent with previously documented cases of pendulous crop in poultry. Similar clinical presentations were reported by Ebling *et al*. (2015) in broilers on an experimental farm in Rio Grande do Sul, Brazil, and by Qasim *et al*. (2015) in turkeys managed at the Vom Teaching and Research Farm in Plateau State, Nigeria. Factors such as impaired crop motility, bacterial or fungal overgrowth, and anatomical abnormalities are recognized contributors to crop dysfunctions (Çelik & Kıvanç, 2020; Abdalla *et al*., 2022). In this case, the microbiological isolation of *E. coli* suggests that secondary bacterial infection exacerbated the condition, as documented in other studies where bacterial overgrowth complicated primary crop stasis (Watts & Wigley, 2024).

The combination of clinical examination and microbiological analysis was critical in confirming the diagnosis. The isolation of *E. coli* from the crop content corroborates findings from similar cases where opportunistic pathogens contributed to crop stasis (Kuznetsova *et al*., 2020; Pilati *et al*., 2024). Hematological results indicated hypoproteinemia and hypoglycemia, likely due to impaired nutrient absorption, as reported in other gastrointestinal disorders in birds (Mitchell & Johns, 2008; Ebling *et al*., 2015).

The absence of foreign body impaction or fungal elements rules out other differentials such as crop impaction or sour crop. While radiographic imaging and advanced laboratory analyses could have provided further confirmation, the available diagnostic tools were sufficient for establishing the diagnosis in this resource-limited setting.

Surgical intervention, particularly ingluviotomy, was necessitated by the persistence of clinical signs despite conservative management. The surgical technique employed, including a two-layer closure of the crop, aligns with best practices in avian surgery to ensure optimal healing and prevent leakage (Laku *et al*., 2021). Postoperative care, including systemic antibiotic therapy with enrofloxacin and topical oxytetracycline, effectively managed the secondary bacterial infection, consistent with the sensitivity profile obtained from the antibiogram analysis. The use of fluoroquinolones as the primary antimicrobial agent is supported by their broad-spectrum activity and efficacy in avian infections (Charleston *et al*., 1998; Millanao *et al*., 2021).

The turkey's recovery, as evidenced by the resolution of clinical signs and return to normal activity within 10 days, highlights the effectiveness of the chosen management protocol. The inclusion of glucose in the drinking water addressed hypoglycemia and supported metabolic recovery, a strategy similarly reported in post-surgical management of gastrointestinal conditions in birds (Braun & Sweazea, 2008). The absence of complications such as wound dehiscence or recurrence of crop distension underscores the importance of meticulous surgical and postoperative care.

Pendulous crop is often associated with factors such as dietary imbalances, genetic predisposition, or management practices that impair crop motility (Reed, 2009; Ebling *et al.*, 2015). In this case, the semi-intensive management system and the bird's dietary history may have contributed to the condition. While no other flock mates were affected, it is crucial to consider flock-wide preventive measures, such as diet modification and regular crop palpation, to mitigate future cases.

The findings of this case study are consistent with the literature indicating that crop dysfunctions in avian species are multifactorial and require a multidisciplinary diagnostic and therapeutic approach as reported by Ebling *et al*. (2015) and Qasim *et al.* (2015). While surgical intervention is effective, addressing underlying factors such as infections and management practices is critical for long-term prevention (Abdalla *et al.*, 2022; Laku *et al*., 2021).

CONCLUSION

Pendulous crop is a condition that can have serious implications for avian health. This case report emphasizes the importance of a thorough diagnostic approach, including endoscopy, in confirming the diagnosis. It also underscores the need for a comprehensive management strategy that includes both surgical and non-surgical interventions, tailored to the individual bird's condition. To prevent pendulous crop, proper feeding practices, balanced diets, and regular veterinary care are essential. Further research is warranted to assess the prevalence of this condition in local turkey populations and to better understand its underlying causes.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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