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A Regional Analysis of Pathological Changes Identified by Necropsy in Poultry

Canan AKDENİZ İNCİLİ [1, a]
Zeynep YERLİKAYA [2, b]
Yeliz YALIKAYA KALPAKLIOĞLU [1,c]
Yesari ERÖKSÜZ [1, d]

[1] Fırat University,
Faculty of Veterinary Medicine,
Department of Pathology,
Elazığ, TÜRKİYE

[2] Fırat University,
Faculty of Veterinary Medicine,
Department of Microbiology,
Elazığ, TÜRKİYE

[a] ORCID: 0000-0003-1893-7531
[b] ORCID: 0000-0001-6895-2727
[c] ORCID: 0009-0002-8212-3006
[d] ORCID: 0000-0001-5962-8810

Avian necropsy is an important diagnostic tool for identifying health problems in poultry and other bird species. This study evaluated 35 avian necropsy cases submitted over a 9-month period between April 2025 and January 2026, including 16 turkeys, 17 chickens, 1 quail, and 1 stork. Among these cases, 16 showed lesions associated with bacterial infections, including pericarditis (1), airsacculitis (7), fibrinous pneumonia (6), coligranuloma (1), and hepatitis (3); 7 were associated with viral disease; 4 were associated with parasitic disease, including hepatitis and typhlitis caused by *Histomonas meleagridis*; 1 case was attributed to trauma; and 7 showed no significant macroscopic or microscopic findings. Bacterial respiratory lesions represented the largest diagnostic category and were observed most often in cases submitted during the spring and summer months. These findings highlight the diagnostic value of necropsy in avian disease investigation and provide regional data on the distribution of lesions in submitted cases.

Key Words: *Avian species, lesion, necropsy, pathology*

Kanatlı Hayvanlarda Nekropsi ile Tanımlanan Patolojik Değişikliklerin Bölgesel Analizi

Kanatlı hayvan nekropsisi, özellikle kümes hayvancılığı sektöründe potansiyel sağlık tehditlerinin belirlenmesinde veteriner hekimler tarafından kullanılan etkili tanı yöntemlerinden biridir. Bu çalışmada, Nisan 2025 ile Ocak 2026 tarihleri arasındaki 9 aylık dönemde nekropsisi yapılan toplam 35 kanatlı hayvan değerlendirildi. Olguların 16'sını hindi, 17'sini tavuk, 1'ini bıldırcın ve 1'ini leylek oluşturdu. Bu vakaların 16'sında perikardit (7), airsakkülit (7), fibrinöz pnömoni (6), koligranülom (1) ve hepatit (3) gibi bakteriyel etkenlerle ilişkili lezyonlar saptandı. Yedi vaka viral, dört vaka ise *Histomonas meleagridis*'in neden olduğu hepatit ve tiflit dahil olmak üzere paraziter kökenli olarak değerlendirildi. Bir vaka travmaya bağlıydı; yedi hayvanda ise makroskobik veya mikroskobik bulguya rastlanmadı. Bakteriyel solunum sistemi lezyonlarının en sık karşılaşılan bulgular arasında yer aldığını ve bu olguların özellikle ilkbahar ve yaz aylarında daha fazla görüldüğünü ortaya koydu. Bu sonuçlar, bakteriyel hastalıkların bölgesel dağılımının anlaşılmasında nekropsinin önemli bir tanısal araç olduğunu göstermektedir.

Anahtar Kelimeler: *Kanatlı hayvan, lezyon, nekropsi, patoloji*

Introduction

Poultry meat is an important source of animal protein for balanced and adequate human nutrition and is therefore one of the most widely consumed food products worldwide. It offers several advantages, including high nutritional quality, good palatability, relatively affordable cost compared with red meat, ease of production, and broad acceptance across different segments of society (1).

Poultry products, including meat and eggs, represent an important means of meeting human needs for animal protein (2). Population growth, increasing consumption, and rapid urbanization have contributed to a steady rise in the demand for poultry products. Poultry meat, particularly chicken meat, is the most popular type of white meat, and its consumption is expected to continue increasing over the next decade (3). Annual poultry production is projected to exceed 37 billion animals by 2050 (4). In Türkiye, poultry products supply a substantial share of basic nutritional needs and continue to expand within the livestock sector (Table 1) (5).

Among the most important factors threatening poultry production in Türkiye are flock-level poultry diseases, which can lead to substantial economic losses. Therefore, early diagnosis and the prevention of flock-related problems are of critical importance. In addition, the most frequently encountered bacterial agents causing disease in poultry include *Salmonella* spp., *Escherichia* spp., *Clostridium* spp., *Staphylococcus* spp., *Campylobacter* spp., *Bacillus* spp., and *Listeria* spp. These bacterial infectious agents may also cause disease in humans through poultry-derived food products. Thus, poultry diseases not only result in economic losses in poultry production but also pose serious public health concerns (6-9).

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Correspondence

Yesari ERÖKSÜZ
Fırat University,
Faculty of Veterinary Medicine,
Department of Pathology
Elazığ – TÜRKİYE

yeroksuz@firat.edu.tr

Bacterial, viral, fungal, parasitic, and nutritional diseases that significantly affect productivity in poultry can largely be identified through necropsy findings and the macroscopic and microscopic examination of lesions. This is highly important for preventing major potential losses. To date, numerous studies have been conducted, and continue to be conducted, to improve and increase poultry production; therefore, updating the current body of knowledge remains essential for future studies (10-12). The aim of this study was to evaluate poultry diseases observed in both small-scale and industrial poultry enterprises in our region and to obtain up-to-date data.

Materials and Methods

Research and Publication Ethics: According to the Directive of the Local Ethics Committee for Animal Experiments of Fırat University, ethics committee approval was not required for this study, as it was considered within the scope of non-experimental clinical veterinary practice. Between 14.04.2025 and 01.01.2026, necropsies were performed on a total of 35 avian animals (16 turkeys, 17 chickens, 1 quail, and 1 stork) brought to the Department of Pathology, Faculty of Veterinary Medicine, Fırat University, from Elazığ and neighboring provinces (Table 2). Following necropsy, tissue samples were collected from lesioned areas for histopathological examination. These samples were processed routinely, serial sections of 3–5 µm thickness were obtained, and the prepared sections were stained with Hematoxylin and Eosin and examined and photographed under a light microscope.

Bacteriological Isolation and Phenotypic Identification: Lung, liver, and air sac samples collected from the birds were aseptically inoculated onto 5% sheep blood agar (Oxoid, United Kingdom) and incubated aerobically at 37°C for 24 hours. Colonies showing growth were subcultured onto MacConkey agar and Eosin Methylene Blue (EMB) agar (Oxoid, United Kingdom) and re-incubated under the same conditions. Gram staining, catalase, and oxidase tests were used for the phenotypic examination of the isolates.

For the isolation of *Salmonella* spp., 1 g of liver sample was weighed and subjected to pre-enrichment in 9 mL of Buffered Peptone Water (Merck, Darmstadt, Germany) at 37°C for 24 hours. After pre-enrichment, 0.1 mL of this culture was transferred into Rappaport-Vassiliadis broth (Merck, Darmstadt, Germany) and selectively enriched at 42°C for 24 hours. Subsequently, 10 µL from the Rappaport-Vassiliadis broth culture was streaked onto XLT4 agar (Merck, Darmstadt, Germany), and the plates were incubated aerobically at 37°C for 24 hours. Suspected colonies obtained were purified, and MacConkey agar, EMB agar, Gram staining, oxidase testing, and Triple Sugar Iron (TSI) agar were used for phenotypic identification.

Statistical Analysis: The collected data were classified according to disease type. Statistical analyses were performed using the SPSS software package (IBM SPSS Statistics for Windows, Version 22.0), employing Fischer's Exact Chi-square Test. The main effects and interactions of the data are presented as mean ± standard error. Statistical significance was set at $p<0.05$.

Results

Macroscopic Findings: Among the 35 avian animals examined, 16 exhibited lesions associated with bacterial agents, including pericarditis, airsacculitis, fibrinous pneumonia, coligranuloma, and hepatitis; 7 had lesions consistent with viral infection; 4 had parasitic lesions, including hepatitis and typhlitis caused by *Histomonas meleagridis*; 1 case was attributed to trauma; and 7 birds showed no macroscopic or microscopic abnormalities (Figures 1A–1H).

Histopathological Findings:

Liver; In the liver, pseudoglandular arrangement of hepatocytes, subcapsular hemorrhages, periportal inflammatory cell infiltration, and fibrosis (Figure 2A), multifocal typhoid nodules (Figure 2F) were observed.

Cecum; In the cecum, diffuse inflammatory cell infiltration and congestion were detected (Figure 2B), multifocal typhoid nodules and diffuse lymphohistiocytic infiltrations were observed.

Pericarditis; Widespread lymphocytic infiltration was observed in the heart.

Heart; In the heart, subepicardial lymphohistiocytic infiltrations were observed (Figure 2C).

Airsacculitis: In the air sacs, randomly distributed lymphohistiocytic infiltrations and foci of caseous necrosis were observed (Figure 2D).

Lungs; The lungs exhibited diffuse congestion, perivascular edema, widespread heterophilic infiltration, and fibrin accumulation within the interstitial tissues (Figure 2E).

Table 1. Poultry and egg production amounts in Turkey for 2023 and 2024

	August			January–August		
	2023	**2024**	**Change (%)**	**2023**	**2024**	**Change (%)**
Chicken meat (Ton)	203 060	214 432	5.6	1 530 795	1 616 322	5.6
Slaughtered chickens (One thousand)	111 780	118 723	6.2	834 322	888 309	6.5
Chicken egg (One thousand)	1 759 824	1 808 368	2.8	13 392 735	14 043 631	4.9
Turkey meat (Ton)	3 920	3 789	-3.3	31 166	36 504	17.1

Table 2. Information about the animals

Protocol number	Date of arrival	City	Animal Species/age	Histopathological Diagnosis	Bacterial agent
6817-6820	14.04.2025	Kahramanmaraş	Turkey 1 month	Pericarditis, Air sacculitis	*E. coli*
6834	22.04.2025	Elazığ	Quail 2 months	Liver necrosis	*Salmonella spp.*
6854	26.05.2025	Elazığ	Chicken 3 months	Air sacculitis	*E. coli*
6867	10.06.2025	Elazığ	Turkey 4 months	Fibrinous pneumonia	*Pasteurella* spp.
6872-6873	19.06.2025	Kahramanmaraş	Turkey 3 months	Hepatitis, typhlitis (*Histomonas meleagridis*)	-
6874	20.06.2025	Tunceli	Turkey 3 months	Fibrinous pneumonia	*Pasteurella* spp.
6875	20.06.2025	Tunceli	Turkey 4 months	Coligranuloma	*E. coli*
6879	25.06.2025	Elazığ	Turkey 5-6 months	Liver necrosis	*Salmonella* spp.
6880-6881	25.06.2025	Kahramanmaraş	Turkey 4 months	Hepatitis, typhlitis, fibrinous pneumonia (*Histomonas meleagridis*)	-
6882	26.06.2025	Elazığ	Chicken	Air sacculitis	*E. coli*
6892	17.07.2025	Elazığ	Stork	Trauma	-
6896-6897	25.07.2025	Elazığ	Turkey 6 months	Air Sacculitis	*E. coli*
6899-6900	28.07.2025	Elazığ	Turkey 3 months	Pneumonia, uricosis	*Pasteurella* spp.
6905-6907	31.07.2025	Tunceli	Chicken 40 days	Hyperemia and hemorrhage in the proventriculus, cecal tonsils. (Histopathological findings consistent with Newcastle disease)	-
6914-6916	27.08.2025	Elazığ	Chicken 7-8 months	Hyperemia and hemorrhage in the proventriculus, cecal tonsils (Histopathological findings consistent with Newcastle disease)	-
6928	26.09.2025	Elazığ	Chicken 2 year-old	Liver necrosis	*Salmonella* spp.
7224-7230	24.11.2025	Elazığ	Chicken 2-3 months	Sudden death; absence of any observable signs.	-
7250	18.12.2025	Elazığ	Chicken	Microscopic findings consistent with Marek's disease.	-

Table 3. Distribution of the lesions type

Etiological agent	n	Frequency %	*p*-value X^2- value
Bacterial	16	%45.71[a]	
Parasitic	4	%11.43[b]	
Viral	7	%20.00[ab]	*p*=0.0012 X^{22}=18.00
Traumatic	1	%2.86[b]	
Lesion-free	7	%20.00[ab]	

[a, b]: The difference in frequencies between the letters in each column is significant (χ^2 (chi-square)=18.00 ve *p*=0.0012)

Microbiological Findings: Microbiological examination revealed the isolation of *E. coli* from 9 air sac samples, *Salmonella* spp. from 3 liver samples, and *Pasteurella* spp. from 4 lung samples. The *E. coli* isolates produced pink to red colonies on MacConkey agar, consistent with lactose-positive characteristics, and exhibited colonies with dark centers and a greenish metallic sheen on EMB agar. On Gram staining, these isolates appeared as Gram-negative bacilli and were catalase-positive and oxidase-negative.

The *Salmonella* spp. isolates formed typical suspicious colonies with black centers on XLT4 agar and showed colorless colonies on MacConkey agar, consistent with lactose-negative characteristics. They were observed as Gram-negative bacilli on Gram staining and were catalase-positive and oxidase-negative. In addition, these isolates showed an alkaline slant/acid butt (K/A) reaction with H_2S production on TSI agar, consistent with glucose fermentation and the absence of lactose and sucrose fermentation.

The *Pasteurella* spp. isolates formed small, grayish-translucent, non-hemolytic colonies on blood agar and showed no growth on MacConkey agar. On Gram staining, they appeared as Gram-negative coccobacilli and yielded positive reactions for both catalase and oxidase tests.

Figure 1A–H. Gross pathological findings in visceral organs. **(A)** Liver exhibiting multifocal to coalescing, irregular, pale-yellow necrotic foci scattered throughout the parenchyma (arrow). **(B)** Cecum characterized by multifocal necrotic lesions and abundant friable, yellow-white caseous material on the mucosal surface and within the lumen (star). **(C–D)** Heart with multifocal, irregular, pale-white to yellow necrotic foci extending into the myocardium. **(E)** Air sac containing adherent, opaque, yellow-white caseous exudate, consistent with airsacculitis (star). **(F)** Lung containing fibrinonecrotic, yellow-white caseous exudate on the pleural surface and within affected parenchymal areas (star). **(G)** Liver and heart showing multifocal pale discoloration associated with necrotic parenchymal lesions. **(H)** Pericardium displaying pale-yellow necrotic plaques and foci, consistent with fibrinonecrotic pericarditis (arrow).

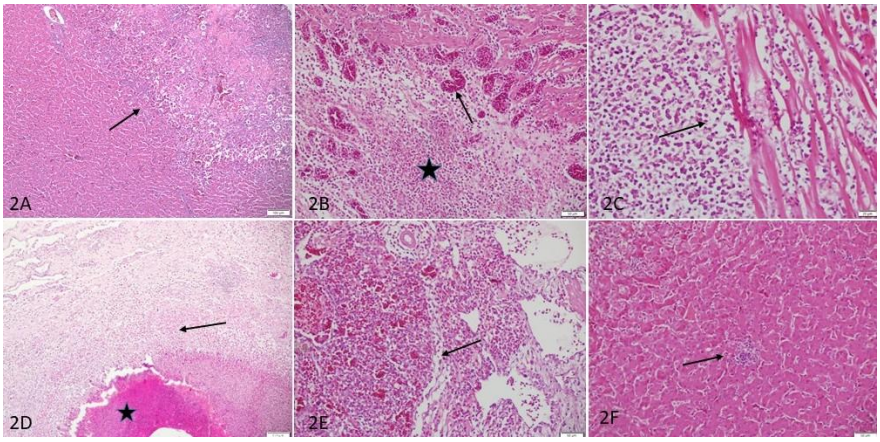

Figure 2A–F. Histopathological findings in visceral organs. **(A)** Liver exhibiting focal to multifocal hepatocellular necrosis, loss of hepatic cord architecture, cytoplasmic hypereosinophilia, karyorrhexis, karyolysis, and inflammatory cell infiltration (arrow). **(B)** Cecum characterized by diffuse transmural inflammatory infiltration, hemorrhage, mucosal necrosis, and luminal necrotic cellular debris (star). **(C)** Heart with diffuse lymphocytic myocarditis, including interstitial and perivascular lymphocytic infiltration separating myocardial fibers (arrow). **(D)** Air sac displaying lymphohistiocytic inflammation (arrow) and focal caseous necrosis composed of amorphous eosinophilic debris and degenerate inflammatory cells (star). **(E)** Lung characterized by diffuse vascular congestion and heterophil-rich inflammatory infiltration within the interstitium and air spaces, consistent with acute fibrinopurulent pneumonia (arrow). **(F)** Liver containing multifocal typhoid nodules composed of macrophages, heterophils, and necrotic cellular debris within the hepatic parenchyma (arrow).

Discussion

The results of the present study demonstrated that bacterial infections were the diagnostic category among the avian cases accounting for 45.71%, this was followed by viral cases and individuals without lesions: 7 cases each (20.00%), parasitic cases were identified as 4 (11.43%), whilst traumatic cases were only 1 (2.86%). of all avian cases submitted from Elazığ and neighboring provinces to the Department of Pathology, Faculty of Veterinary Medicine, Fırat University, between 14 April 2025 and 18 December 2025 (Table 3). Of these bacterial cases, 13 involved the respiratory system and 3 involved the digestive system. In addition, disease occurrence increased during the spring and summer months. In the current study, *E. coli* was identified as the causative agent in nine cases of bacterial infections of the respiratory system. It is well known that colibacillosis, a prevalent bacterial infection, has been identified as a significant health concern affecting poultry worldwide. The disease has been documented to frequently result in air sacculitis (coligranuloma) and pericarditis, with its prevalence exhibiting regional variation. This variation has been attributed to climatic and farming practices (13).

In the present research, *Salmonella* spp. was isolated from three cases of bacterial infections of the digestive system. The macroscopic and microscopic findings observed in these cases where *Salmonella* spp. was isolated are consistent with the literature. In this context, previous studies have also demonstrated that salmonellosis causes widespread areas of macroscopic necrosis in the liver and typhoid nodules at the microscopic level (14).

A macroscopic and microscopic examination revealed dilatation of the cecum, a significant quantity of necrotic material within the cecum, and necrotic pale areas were observed in the liver. These findings are consistent with those reported in other studies where histomoniasis (*Histomonas meleagridis*) on this subject (15). Furthermore, in the case where Marek's disease was suspected, widespread pale areas were observed macroscopically in the heart, and widespread lymphocytic infiltration was observed microscopically; these findings are consistent with those reported in previous cases (16).

A previous study conducted using data obtained from the Turkish Ministry of Agriculture and Forestry and the Turkish Statistical Institute (TÜİK) similarly reported that bacterial and parasitic diseases were the predominant causes of disease and that their frequency increased during the spring and summer seasons. Bacterial diseases are commonly encountered in poultry flocks due to inadequate ventilation, poor hygiene conditions, overcrowding, and insufficient implementation of infection control measures (17). Accordingly, it is essential to ensure adequate ventilation in poultry farms, avoid housing different animal species together, improve hygiene conditions, strengthen preventive measures against bacterial infections, and optimize nutritional management.

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