

# Ultrasonographic features of Marek's disease in a chicken

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## Abstract

A 4-year-old chicken was presented with a history of anorexia, depression, and blindness. An ultrasound examination of the coelomic cavity was performed that revealed splenomegaly, hepatic nodules, and hypoechoic thickening of the intestinal wall. Ultrasonography of the coelomic cavity was done and revealed splenomegaly, nodular hepatic changes, and hypoechoic thickening of the intestinal wall. A diagnosis of Marek's disease was made based on the history and extension of the abdominal organ changes and confirmed by histopathology. This study describes an ultrasonographic appearance of Marek's disease in a chicken and emphasizes the importance and benefits of ultrasonography in staging the progression of Marek's disease.

## KEYWORDS

backyard chicken, diagnostic imaging, fowl paralysis, Herpes virus, poultry

## 1 | SIGNALMENT, HISTORY, AND CLINICAL FINDINGS

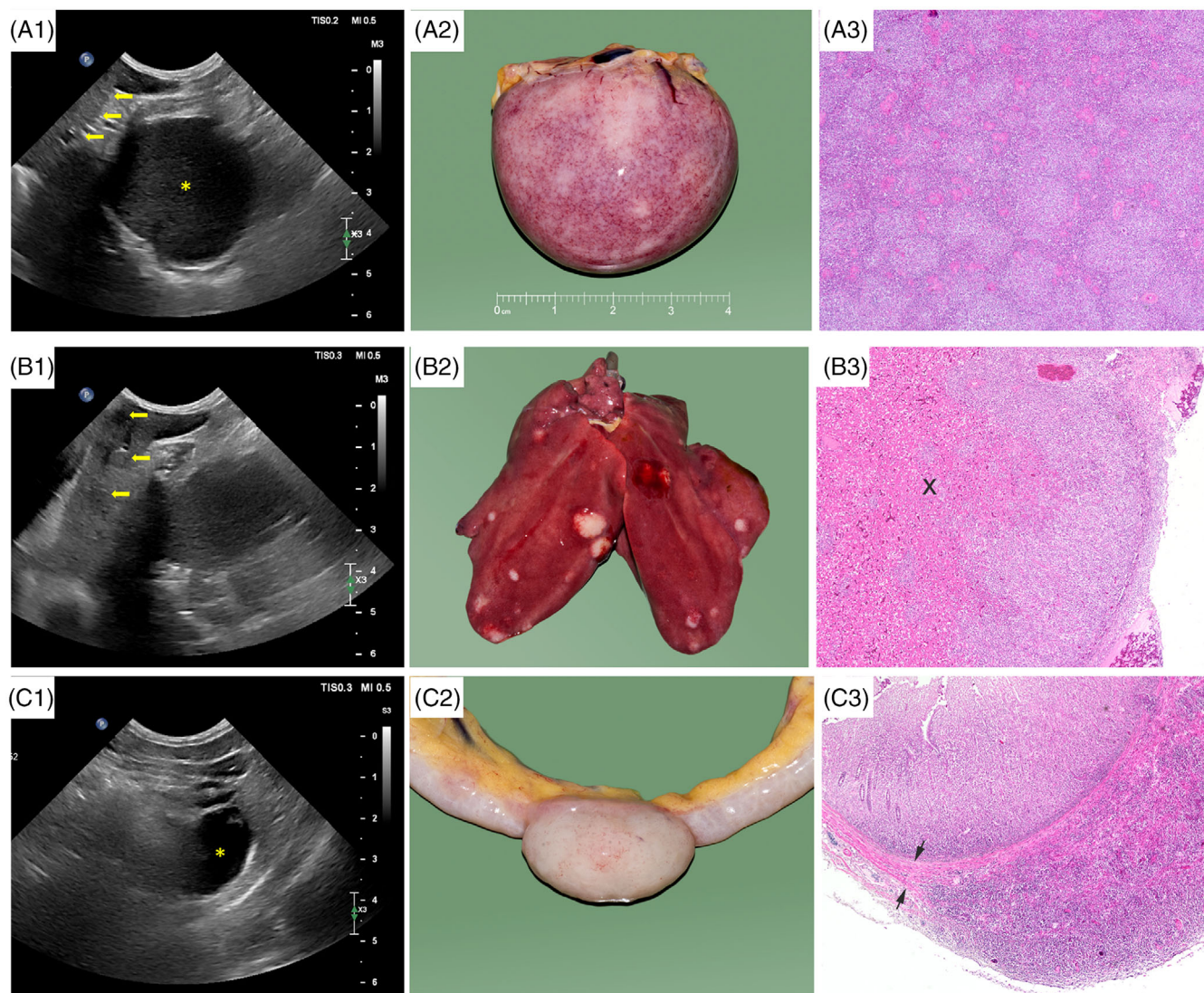
A 4-year-old pet chicken (*Gallus gallus domesticus*) was presented to the Clinic of Avian and Reptile Medicine, University of Veterinary Medicine, Vienna, Austria, with a history of anorexia and depression for about 3 days. The bird was blind and changes compatible with Marek's disease (MD) such as an irregular pupil as a result of infiltration of the cells into the iris were detected previously by its primary care veterinarian. A clinical examination revealed poor body condition score and pectoral muscles' atrophy. The body weight of the chicken was 1669 g at the time of presentation. The crop was fluid-filled. Palpation of the coelomic cavity was unremarkable. No ectoparasites were detected. Fecal testing was negative for endoparasites. The blindness and pupil changes were confirmed; however, no concurrent traumatic changes were detected. Polymerase chain reaction testing of tracheal secretions was negative for the avian influenza virus.

## 2 | IMAGING FINDINGS, DIAGNOSIS, AND OUTCOME

An ultrasound evaluation of the coelomic cavity was performed in a standing position using Philips EPIQ Elite ultrasound machine (Philips Ultrasound Inc., USA) equipped with a multifrequency transducer (mC12-3). The spleen was well-demarcated with smooth margins, had an oval to triangular contour, and was located directly caudal to the liver and medial to the proventriculus and ventriculus. The spleen was measured 3.6 cm in long-axis and interpreted enlarged based on the previously reported normal reference range in the literature (17.0–22.1 mm)<sup>1</sup> and showed a homogenous hypoechoic parenchyma compared with the liver (Figure 1A). A central blood flow branching to the periphery was detected by power Doppler examination (Figure 2). The liver was slightly enlarged and extended beyond the border of the sternum with irregular borders and showed multiple well-defined, iso- to hypoechoic intraparenchymal nodules with different sizes mainly

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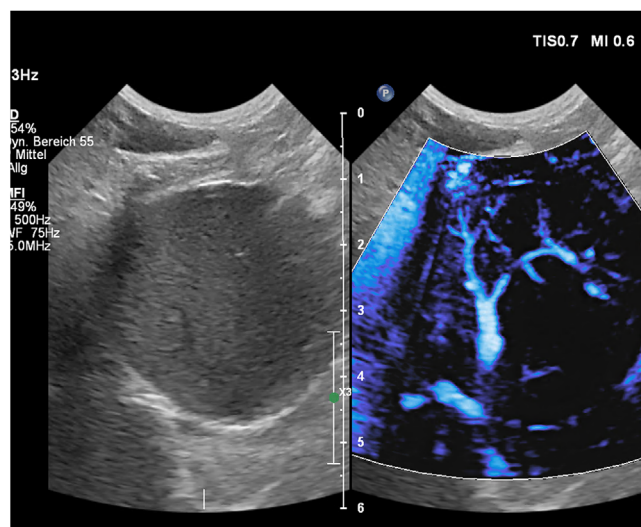


**FIGURE 1** The figure contains ultrasonograms (A1, B1, C1), pathological lesions in their macroscopic appearance (A2, B2, C2) and corresponding histological section (A3, B3, C3). A1, Ultrasonogram of the enlarged spleen (\*) where arrows outline the caudal border of the liver. A2, Macroscopic appearance of the severe splenomegaly due to (A3) a diffuse infiltration with lymphoid round cells, resulting in a loss of the typical splenic architecture. B1, The sonogram of the liver shows the parenchymal nodules (arrows). B2, The gross pathology of the liver with multiple white nodules and (B3) their appearance in the histological section with normal liver tissue on the left (x). C1, The asterisk marks the hypoechoic focal thickening of the intestinal wall in the sonogram. (C2) Intestine appearance is shown with a focal wall thickening due to the transverse infiltration with lymphoid round cells as shown in the histological section (C3). For a better visualization of the severe transverse infiltration, the muscular layers and serosa are marked by arrows. [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

<5 mm (Figure 1B). The intestinal wall was multifocally up to 3 mm thickened and hypoechoic, and showed remarkable loss of the wall-layer distinction. Additionally, an eccentric hypoechoic thickening was detected at the serosal border of the intestinal wall (Figure 1C). The splenomegaly, hepatic nodules, and intestinal wall infiltration were concluded more likely as a neoplastic infiltration. Given the species and history of the MD, an infiltrative neoplasia associated with a herpes virus (MD) with coelomic organ involvement was periodized. A granulomatous infection with hepatopathy, enteropathy, and splenomegaly was also considered as a less likely differential diagnosis. Based on the poor prognosis due to the extension of the disease and clinical condi-

tion of the patient, euthanasia was offered to the owner. The chicken was euthanized and a necropsy was performed.

On gross evaluation, the intestinal wall was multifocally thickened, and the caecum contained blood and fibrin. Histopathology identified moderate to severe transverse infiltration of the intestinal wall with a heteromorphic population of lymphoid round cells additionally expanding the mucosa. The spleen was severely enlarged and pale due to a severe diffuse infiltration with lymphoid round cells. Multiple well-demarcated white nodules of peppercorn to pea size (about  $1.5 \times 2.5$  cm) were recognized in the liver, which represent perivascular and parenchymal infiltrations by heteromorphic lymphoid round



**FIGURE 2** B-mode sonogram of the enlarged spleen (left); power Doppler examination of the spleen (right). [Color figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

cells in the histopathological examination (Figure 1B). The uvea anterior (ciliary body and iris) and, to some extent, the uvea posterior were infiltrated with lymphoid round cells. Brachial plexus and sciatic nerves were unremarkable, only scattered lymphoid round cells were found in the adjacent fatty tissue. The heart showed a discrete myocardial fiber degeneration with reactive inflammation as well as individual lymphoid round cells. Secondary findings included the presence of moderate pulmonary edema with marked congestion and pneumoconiosis. The necropsy findings confirmed a diagnosis of MD based on the heteromorphic appearance of proliferated lymphoid cells.

### 3 | DISCUSSION

Recently, backyard chickens are increasingly kept as pet birds and, consequently, they are treated as companion animals generating an increasing demand for veterinary care and diagnostic investigations in this species.<sup>1</sup> A recent study by Gros et al.<sup>2</sup> described the normal ultrasonographic findings of the coelomic cavity and organs of hens; however, the current knowledge about the diagnosis of avian diseases by ultrasonography is mainly based on case reports. Accordingly, the abnormal findings in the present study were described based on the general ultrasonographic knowledge of mammals and reference descriptions in the recent study by Gros et al.<sup>2</sup>

Marek's disease virus is ubiquitous, and chickens may be infected in early life and were considered a threat to the poultry industry before the popularity of vaccination.<sup>3</sup> While most birds that develop clinical signs may die, a few birds may recover. Although the diagnosis of MD is done by typical symptoms, necropsy, and biopsy examination of the tissues,<sup>3</sup> ultrasonography is expected to be useful as a paraclinical test helping with the antemortem diagnosis of MD. In the present case, ultrasonography was done to identify and stage the extent of the disease and help both the clinician and the owner to consider the prognosis and make the proper decision for the patient.

Marek's disease is considered a common neoplastic disease of domestic chickens. Herpesvirus infection is considered the main cause of MD, which makes it etiologically different from other avian lymphoid neoplasms.<sup>3</sup> Marek's disease is pathophysiologically a lymphoproliferative and neuropathic disease, which results in an enlargement of the peripheral nerves and lymphatic infiltration in various visceral organs and tissues. The lymphomatous lesions are described in the gonad, lung, heart, mesentery, kidney, liver, spleen, bursa, thymus, adrenal gland, pancreas, proventriculus, intestine, iris, skeletal muscle, and skin, and probably no tissue or organ is without occasional involvement.<sup>3</sup> Accordingly, the clinical signs at the time of the presentation vary depending on the affected organ or nerves. The clinical signs can range from dilation of the crop as a consequence of vagus nerve paralysis and ocular involvement with blindness.<sup>3</sup> These clinical findings were confirmed in our case by clinical examination. Additionally, peripheral nerve dysfunction in MD will result in a progressive paresis and complete spastic paralysis of legs,<sup>3</sup> which was missing in our case.

Lymphoma induced by the herpes virus in most viscera appears as diffuse enlargements, sometimes up to several times the normal size, and a diffuse white or grayish discoloration is often present.<sup>4</sup> An assessment of avian splenic size till now was mainly subjective, and subjectively prominent spleen is often reported as "Splénomegaly" by radiologists. However, the size of the spleen in the present case was subjectively enlarged, the objective evaluation showed almost two to three times enlargement compared with the reference size reported by Gros et al.<sup>2</sup> in the healthy hens (20.5 × 13.8 mm).

Additionally, nodular changes and irregular margins were detectable sonographically and were confirmed in histopathology of the liver as previously reported in the literature.<sup>3</sup> In other cases, a diffuse infiltration of the liver may cause a loss of normal lobule architecture and often gives the surface a coarse granular appearance on the contrary to the nodular appearance.<sup>3</sup> In the present case, ultrasonography revealed intraparenchymal nodules and hepatomegaly; however, the general shape of the liver was not completely altered.

To the best of the author's knowledge, this is the first published report describing the ultrasonographic features of the coelomic organs in a chicken diagnosed with MD. The ultrasonography was useful in this case to characterize the degree of coelomic organs' involvement and provide a prognosis. Additionally, this study suggests that ultrasonography could be a useful and noninvasive test in the evaluation of MD changes in basic and clinical research.

### LIST OF AUTHOR CONTRIBUTIONS

#### Category 1

- Conception and design: Vali, Bagheri.
- Acquisition of data: Vali, Bagheri, Vobornik, Thaller.
- Analysis and Interpretation of data: Vali, Thaller.

#### Category 2

- Drafting the article: Vali, Bagheri.
- Revising article for intellectual content: Vali, Bagheri, Vobornik, Thaller.



## Category 3

- a. Final approval of the completed article: Vali, Bagheri, Vobornik, Thaller.

## Category 4

- a. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: Vali, Bagheri, Vobornik, Thaller.

## CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

## PREVIOUS PRESENTATION OR PUBLICATION DISCLOSURE

This data was not presented in any meeting previously.

## REPORTING CHECKLIST DISCLOSURE

No network reporting checklist was used.

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