Full Length Article

RADIOGRAPHIC EXAMINATION OF THE COELOMIC ORGANS IN RESCUED BLACK KITES (*MILVUS MIGRANS*)

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ABSTRACT

Radiographic imaging is widely used as a relatively quick imaging diagnostic tool in veterinary treatment protocols. Avian radiographic procedures have been standardized in developed countries. But in India, the data on standardization procedures and visualization of coelomic organs in avian species, especially wild birds including raptors, is very limited. As a result, coelomic organ abnormalities are very poorly diagnosed in Indian birds of prey like black kites (Milvus migrans), which are regularly rescued and presented to Indian veterinarians. Standardizing the protocol for radiography of black kites and interpretation standards with survey radiographs could aid in prompt and accurate diagnosis of various conditions like pneumonia, proventricular dilatation, pneumocoelom, intra-coelomic mass, nephromegaly etc. and aid in planning of other techniques for management of various clinical conditions in black kites.

Keywords: Avian, black kite, coelomic organs, radiograph

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INTRODUCTION

X-rays are powerful electromagnetic radiations discovered by the German scientist Wilhelm Conrad Roentgen in the year 1985 (Behling, 2020). They are used for performing radiography to visualize the internal anatomy of the body. Due to continuous advancement in radiography, it has been an excellent non-invasive imaging diagnostic tool in the human as well as in veterinary medicine. Radiographic procedures are relatively quick and one can use it to visualize normal and abnormal soft and hard tissues of various densities to assess them. Radiograph is quite commonly practiced and turned out as an essential imaging diagnostic tool in small animal practice and there are standardised protocols for avian species as well.

Black kites or small Indian kites (*Milvus migrans*) are known to be urban

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raptors which live in a close proximity with humans. They have been flourishing throughout India as they have adapted to feed on discarded waste (SoIB, 2023) and hunt occasionally. During Uttarayan festival where many Indians fly kites in large numbers, there have been many reports of black kites getting injured (Fernandes, 2024) and being presented to veterinarians for treatment. During extreme summer season in India, many black kites can get dehydrated and are unable to fly. Post-rescue or during rehabilitation of these birds, they can get diagnosed with multiple illnesses without visible injury. Such individuals usually show non-specific clinical signs of dyspnoea, anorexia, dullness, lethargy and occasionally regurgitation or diarrhoea. Radiographic assessment of such individuals is rarely done and if used judiciously it can reveal vital information about the status of the internal organs of these rescued birds. It is important that the standard protocol for radiography of wild birds, especially Indian raptors, is carried out as are scanty literature is available on this. This study reports the standardization of the protocol for radiography in rescued black kites.

MATERIALS AND METHODS

The study was conducted at Jivdaya Charitable Trust, Ahmedabad, Gujarat, in the month of August 2024. Four black kites (*Milvus migrans*) (identified as BKG1, BKG2, BKG3 and BKG4) rescued and brought to the centre, were subjected to radiographic examinations. The birds did not have any external physical injuries, but were dull and lethargic. Additionally, one individual had diarrhoea (BKG2) and another individual had a slightly distended neck without any external injury (BKG1). A GXL-D-100 radiographic machine was used with the 60kVp, 20 mA and 5 mAs. The birds were positioned by laying them on their back (ventrodorsal view) and on their side (left lateral view) for radiographic assessment of the internal organs like lungs, heart, liver, oesophagus, proventriculus, gizzard, intestines and kidneys (Ford, 2010) (Fig. 1).

RESULTS AND DISCUSSION

Radiography by the ventrodorsal (VD) view and left lateral (LL) view revealed the various coelomic organs as follows:

Trachea, lungs and air sacs:

The trachea was easily visualized and found to be normal in all the individuals with its cartilaginous rings which were complete (Fig. 2, 3, 4, 5 and 6). The syrinx was not visible clearly due to the overlying ribs. This finding was in agreement with (Doneley, 2018). In the VD view, majority of the lungs were overlapped by outline of the heart and on LL view both the lungs were superimposed. They appeared to possess honey comb like characteristic structure which was evident on the LL view, in agreement with the findings by Krautwald-Junghanns *et al*. (2010). The lungs of the BKG1 (Fig.2 and Fig. 3) appeared congested as there was radio opacity present possibly due to the diffused pattern on both VD and LL views. Such loss of honey comb like structure might be due to any infectious cause (Green *et al*., 2006). For further confirmation and diagnosis of

the lung related abnormality, computed tomography is advised. The air sacs were healthy in all individuals as they had no radio opacity. Only one individual (BKG2, Fig 4.) had extra darkened thoracic air sac which indicated distension of the same. Minor perforation in air sacs might lead to the accumulation of air in between liver and gizzard (pneumocoelom). This finding was in agreement with (Ackerman, 1992).

Liver and spleen:

The liver was visualized in all four individuals. On the VD view, the heart was in association with the liver, forming the 'hour glass' appearance which was in agreement with Samour (2015) and Chitty and Monks (2018). On VD view the lateral margins of the liver did not extend beyond a line formed between the coracoid and acetabulum except in BKG1 (Fig. 2) individual, where the liver was laterally enlarged (hepatomegaly). The aetiology can be infectious (herpes and other viruses, psittacosis, and tuberculosis), intoxication, fatty liver degeneration neoplasia, and metabolic diseases (Coles, 2007). Further assessment of liver can be done by ultrasound. The liver occupied around one-third of the ventral coelom in the LL view, which showed that it is located caudal to the heart. A small space between the ventral proventriculus and dorsal liver was observed in healthy birds. Complete spleen was visualized only in two individuals (BKG2 and BKG3, Fig 4. and Fig 5.) in LL view. The spleen was located on the dorsal side of the proventricular-ventricular junction (Doneley, 2007). It was in agreement with the observations of Krautwald-Junghanns et al. (2010), where the spleen was visible in LL view in about 30% of radiographic pictures of giant parrots. However, on VD view, the spleen was not visible.

Digestive system:

The crop, which was moderately radiopaque, was present at the cervical region of the bird (Fig. 5 and Fig. 6). On LL view, oesophagus ran dorsal to the heart and connected to the proventriculus which further merged with round structured gizzard (Fig. 3) as documented by Doneley (2018). One individual (BKG3) had radio opaque grit in the ventriculus (Fig. 5). Another one (BKG1, Fig. 3) had distended proventriculus which could be due to the ingestion of meat pieces by the individual before the radiography procedure. Other possible reason in case of abnormally distended proventriculus could be due to foreign body, neurogenic proventricular dilatation disease (PDD, where massive dilatation of the proventriculus is seen), infection by *Macrorhabdus ornithogaster*, *Streptococcus spp*. or *Escherichia coli* and vitamin A deficiency (Coles, 2007; Samour, 2015). Caudal to the ventriculus was the intestine and it was made up of largely indistinguishable loops. Only in BKG3 (Fig. 5), the major portion of the intestines appeared a bit dilated as the bird had the history of diarrhoea, which could be due to a chronic infection or parasitic load. Contrast studies can be helpful in such cases as per Chitty and Monks (2018). Cloaca was at the base of the tail and was quite globular. It could be due to air trapping which can also happen due to aspergillosis (Chitty and Lierz, 2008).

Urogenital system:

The kidneys were readily visible on the LL view but were undetectable on VD view due to gastrointestinal tract and overlying bones. The abdominal air sac, which included its dorsal diverticula, enveloped the kidneys. The individual BKG4 (Fig. 6) revealed nephromegaly as there was increase in the size of the kidneys dorso-ventrally. Neoplasia, cysts, metabolic disorders, bacterial infections, Chlamydia psittaci infection, post renal blockage, heavy metal toxicity, and vitamin A deficiency could be the reason for the nephromegaly (Samour, 2015). The testicles or ovaries which may be slightly ventral to the kidneys' cranial division (Krautwald-Junghanns *et al*., 2010) could not be visualized in the individuals. Similarly, presence of egg or similar structures was not visible on the survey radiographs done in these four black kites.

Cardiovascular system:

The heart was quite radiopaque and was visualized on both the views in all individuals (Figs. 2, 3, 4, 5 and 6). It was found to be located in between second and sixth ribs (Chitty and Monks, 2018). On VD view it was in association with liver and formed an 'hour glass' shape as the apex was merging with the liver shadow in normal individuals. On LL view it was possible to visualize all the major blood vessels which appeared cord like, as documented by Chitty and Lierz (2008) and Krautwald-Junghanns *et al.* (2010) (Figs. 3, 4, 5 and 6). There was no evident increase in radiopacity of the heart as its presence would have indicated atherosclerosis pericardial effusion, pericarditis, or epicarditis (Doneley, 2007 and Krautwald-Junghanns *et al.*, 2010). Further assessment of the heart should be done with echocardiography for better understanding.

CONCLUSION

Health assessment of rescued wild animals is vital before rehabilitation. It involves both invasive and non-invasive methods. Wild birds especially raptors are prone to stress and capture myopathy while carrying out invasive procedures. Application of non-invasive methods like radiography minimizes the stress effect due to handling and also provides a holistic picture of the physical status of the individual. In this study, the rescued black kites (*Milvus migrans*) were subjected to radiographic examination for studying the coelomic organs. The normal appearance of the various organs was recorded along with abnormalities like pneumocoelom, hepatomegaly and nephromegaly. Further use of imaging techniques like ultrasonography and computed tomography along with haematological and biochemical parameters are advised for confirmation of such abnormalities.

Fig. 1. Radiographic examination (VD view) on a black kite (*Milvus migrans*).

Fig. 2. T-Trachea, H-Heart, *-Liver border, #-Radio opacity observed in lung and GI-Gastrointestinal tract (distended), of black kite BKG1.

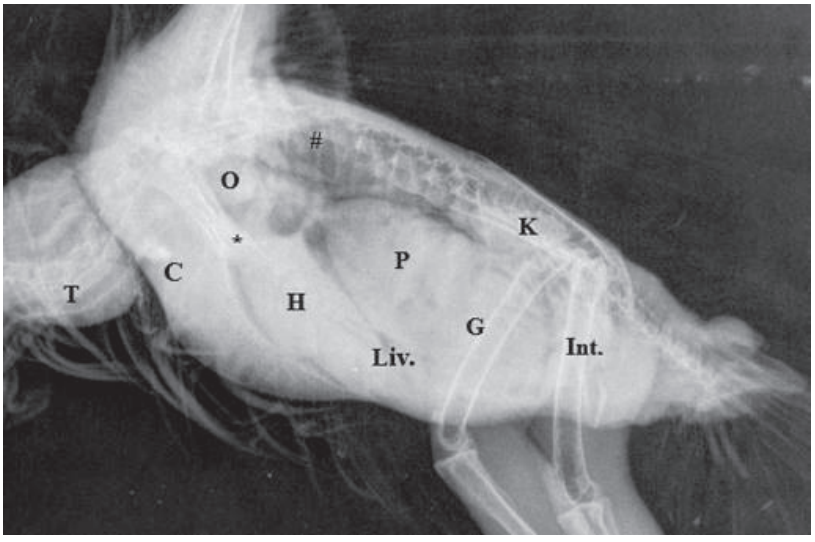

Fig. 3. T-Trachea, H-Heart with *-brachiocephalic trunk, Liv.-Liver, #-Radio opacity in lung, C-Crop, O-Oesophagus, P-Proventriculus (distended), G-Gizzard, K-Kidney and Int.-Intestines, of BKG1.

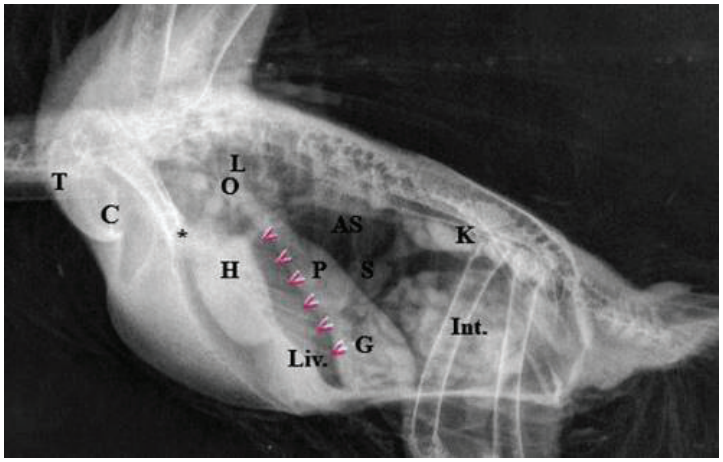

Fig. 4. T-Trachea, H- Heart with *-brachiocephalic trunk, Liv.-Liver, S-Spleen, L-Lung, AS-Air sacs, C-Crop, O-Oesophagus, P-Proventriculus, G-Gizzard, Int.-Intestines K-Kidney, Air present in between liver and gizzard (red arrowheads), of BKG2.

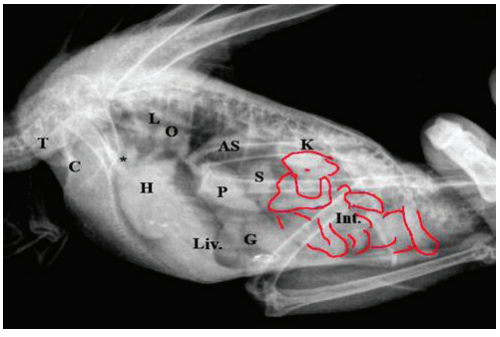

Fig. 5. T-Trachea, H-Heart with *-brachiocephalic trunk, Liv-Liver, S-Spleen, L-Lung, AS-Air sacs, O-Oesophagus, C-Crop, P-Proventriculus, G-Gizzard (with radiopaque grit), Int.-Intestines (which appear inflamed, demarcated with red lines) and K-Kidney, of BKG3.

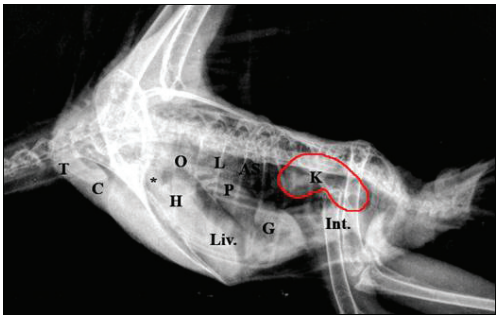

Fig. 6. T-Trachea, H-Heart with *-brachiocephalic trunk, Liv.-Liver, S-Spleen, L-Lung, AS-Air sacs, O-Oesophagus, C-Crop, P-Proventriculus, G-Gizzard, Int.-Intestines, K-Kidney (which appears inflamed) demarcated with red lines, of BKG4

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