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ORIGINAL ARTICLE

Ultrasonographic changes in dogs naturally infected with tick borne intracellular diseases

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Abstract Tick-borne infectious diseases constitute an emerging problem in Veterinary Medicine. The study was undertaken to find out the ultrasonographic changes of liver and spleen in 101 positive cases of tick borne intracellular haemoparasitic diseases in dogs. Abdominal survey of ultrasonography revealed hypo echogenicity of liver, gall bladder distension, splenomegaly, hepato-splenomegaly and ascites in various tick born intracellular diseases viz. ehrlichiosis, babesiosis, anaplasmosis, hepatozoonosis and in mixed infection. Correlating these USG finding with other laboratory examination will be very much useful to spot the diseases condition and organ involvement in tick born intracellular diseases of dog.

Keywords Dog · Gall bladder · Liver · Spleen · Tick borne intracellular diseases · USG

Introduction

Tick-borne infectious diseases constitute an emerging problem in Veterinary Medicine. The main groups of canine tick-borne infections include the protozoan diseases (*Babesia* spp, *Theileria* spp., *Hepatozoon* spp), rickettsial (*Ehrlichia* spp., *Anaplasma* spp., *Rickettsia* spp., *Bartonella* spp.,), bacterial diseases (*Coxiella* spp., and *Borrelia* spp.) and viral infections (tick-borne encephalitis). The main target organs of tick borne intracellular diseases are bone marrow, spleen and lymph nodes and also affect other internal organs such as the liver, kidney, and lungs (Jacobson and Clark 1994). Multiorgan dysfunction with liver and spleen involvement is common in clinical cases of canine monocytic ehrlichiosis (Ganguly and Mukhopadhayay 2008), babesiosis (Mylonakis et al. 2010), anaplasmosis (Carrade et al. 2009) and *H. canis* infection (Baneth 2006). Ultrasonographic changes of liver and spleen in tick borne intracellular haemoparasitic diseases can be used as further diagnostic help apart from other diagnostic procedure. The present study was carried out to know the ultrasonographic changes of liver and spleen in tick borne intracellular haemoparasitic diseases of dog.

Materials and methods

The study was undertaken in Referral Veterinary Polyclinic of Indian Veterinary Research Institute Izatnagar. In the present study 101 cases was positive for tick borne intracellular haemoparasitic diseases like erhlichiosis ($n = 60$), babesiosis ($n = 10$), anaplasmosis ($n = 5$), hepatozoonosis ($n = 4$) and mixed infection ($n = 22$). These cases were selected irrespective of breed, age and sex for ultrasonography study of liver and spleen involvement. Ultrasonographic study in dogs was performed as per the procedures described by Nyland and Mattoon (2002). Ultrasound scanner 200 Vet (Pie Medical, Netherland) or Sonosite modal 600 M and a 5.0 MHz AAS transducer was used for the examination. Abdominal area was shaved and acoustic

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gel was applied on the abdomen before sonogram to ensure an intimate contact of the scan head with the body surface. For ultrasonographic examination of liver, transducer was placed immediately behind the xiphisternum midline and angled cranio dorsally to image a transverse section of liver. Then the transducer was moved gradually caudally remaining on the midline and transducer head was rotated through 90° to image a longitudinal section of liver on midline. For right transverse oblique screen of the gall bladder, transducer was placed on the right side approximately 6–8 cm cranial to xiphoid and 4–5 cm dorsal to the sternum. The transducer was angled towards midline between costal cartilages. For left transverse oblique scan of the gall bladder, the transducer was placed on right 10th–11th inter costal space, 5–10 cm ventral to the spine. Sonograms were evaluated for liver size, shape, contour and its internal architecture including alterations in echogenicity and intensity (anechoic/hypoechoic/hyperechoic/normoechoic), gall bladder (size, shape, wall and its contents) and the presence or absence of free peritoneal fluid. Ultrasonographic imaging of spleen was also performed in spinal recumbency. The spleen was visualized for its size, echogenicity and shape.

Results

USG revealed 49.50 % hypo echogenicity of liver, out of which 38 % (19/50cases) gall bladder distension, in 12.87 %, hepato-splenomegaly in 21.78 % and ascites in 15.84 % out of total 101 positive cases of tick borne intracellular diseases (Table 1 and Fig. 1).

Out of 60 ehrlichiosis cases, hypo echogenicity of liver was observed in 51.67 % out of which ten dogs (32.25 %) had gall bladder distension. Each 20 % of the cases had hepato-splenomegaly and 20 % ascites followed by 8.33 % splenomegaly was observed.

Out of ten babesiosis cases, hypo echogenicity of liver was observed in 30 % out of which two dogs had gall bladder distension (66.66 %). Thirty percentage of the dogs showed ascites followed by each 20 % of the cases had splenomegaly and hepato-splenomegaly.

Out of five anaplasmosis cases, hypo echogenicity of liver was observed in 40 % out of which all the dogs had gall bladder distension. Hepato-splenomegaly was observed in 40 % and s splenomegaly in 20 % of total cases.

Out of four hepatozoonosis, hypo echogenicity of liver was observed in 50 %, out of which one dog had gall bladder distension (50.0 %). Splenomegaly and hepato-splenomegaly was observed in each 40 % of total cases.

Out of mixed infection, hypo echogenicity of liver was observed in 54.55 %, out of which four dogs had gall bladder distension (33.33 %). hepato-splenomegaly was observed in 22.73 % followed by 18.18 % splenomegaly and 4.55 % of ascites of total cases.

Discussion

Abdominal survey of ultrasonography in the present study revealed hyper and hypo echogenicity of liver, gall bladder distension, splenomegaly, hepato-splenomegaly and ascites of various tick born intracellular diseases viz. ehrlichiosis, babesiosis, anaplasmosis, hepatozoonosis and in mixed infection which were in agreement with Kumar (2004).

In case of babesiosis, USG of abdomen revealed hypoechoic images with hepatomegaly and diffuse heterogeneous hypoechoic pattern with generalized splenomegaly (Eduardo et al. 2011) and gallbladder enlargement (Adaszek et al. 2009) which is also agreement with the present study. Kohn et al. (2008) reported splenomegaly with hyper echogenicity of liver in case of anaplasmosis. Sakuma et al. (1987) also reported hypo echogenicity of liver, gall bladder distension in mixed infection (babesiosis and ehrlichiosis, ehrlichiosis and hepatozoonosis, ehrlichiosis and anaplasmosis and babesiosis and ehrlichiosis and hepatozoonosis). Hepato-splenomegaly might have been due to multiplication of organism within circulating mononuclear

Table 1 Ultrasonographic changes of liver and spleen in various intracellular TBDs in dogs

Organ	Erhlichiosis ($n = 60$)	Babesiosis ($n = 10$)	Anaplasmosis ($n = 5$)	Hepatozoonosis ($n = 4$)	Mixed infection ($n = 20$)	Total ($n = 101$)
1. Liver	31 (51.67 %)	3 (30.0 %)	2 (40.0 %)	2 (50.0 %)	12 (54.55 %)	**50* (49.50 %)**
1a. Liver hypoechogenicity						
1b. Gall bladder distention	10/31 (32.25 %)	2/3 (66.6 %)	2/2 (100.0 %)	1/2 (50.0 %)	4/12 (33.33 %)	19/50* (38.0 %)
2. Splenomegaly	5 (8.33 %)	2 (20.0 %)	1 (20.0 %)	1 (25.0 %)	4 (18.18 %)	14 (12.87 %)
3. Hepato-splenomegaly	12 (20.0 %)	2 (20.0 %)	2 (40.0 %)	1 (25.0 %)	5 (22.73 %)	22 (21.78 %)
4. Ascites	12 (20.0 %)	3 (30.0 %)	0	0	1/22 (4.55 %)	16 (15.84 %)

* Gall bladder distention noted in 19 dogs out of 50 dogs showing hyper echogenicity of liver

The bold value indicates more no. of liver hypoechogenicity were noticed than other ultrasonongraphic finding of disorders by intracellular TBDs in dogs

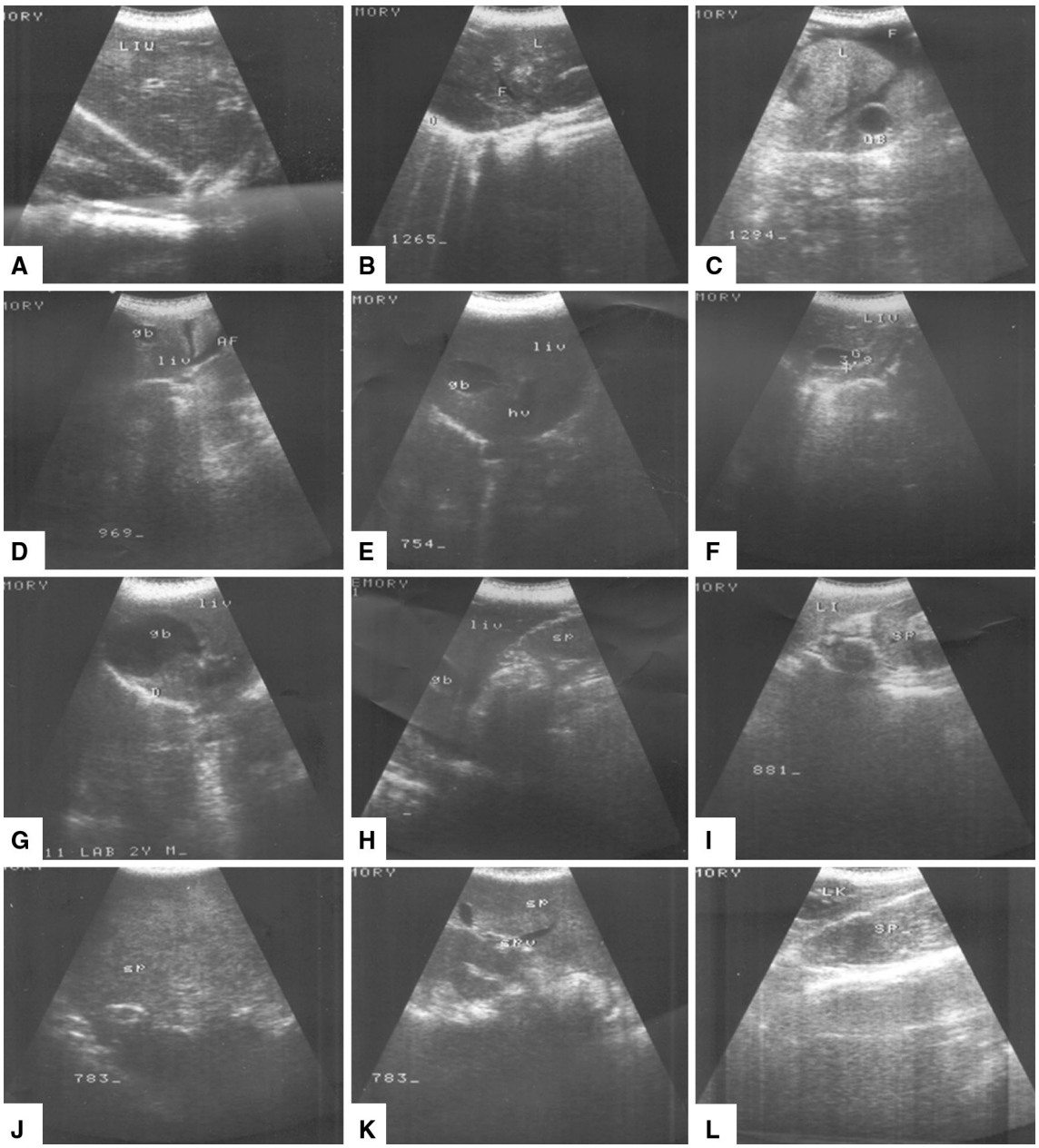

Fig. 1 Abdominal ultrasonographic observation of various intracellular tick born diseases in dogs. USG examination revealed focal hypo echoic with severe hepatomegaly (**a**), focal hyper echoic nodule in liver parenchyma with interlobular fluid (**b**), diffused liver with ascitic fluid (**c**), anechoic structure surrounding on liver (**d**), distended GB with engorged hepatic vein (**e**), Cholecystitis (3.9 mm) with focal hypo echoic liver (**f**), severe gall bladder distension with anechoic fluid filled structure (**g**), hepato-splenomegaly (**h**), Iso-hyper echoic parenchyma of liver and spleen (**i**), severe (**j**), with engorgement of splenic vessel (**k**) and diffused hypo echogenicity of spleen compared to left kidney (**l**)

cells and mononuclear phagocytic tissues of liver, spleen and lymphnode (Hildebrandt et al. 1963). Hepatomegaly in case of tick born intracellular diseases could probably be due to passive congestion, reticuloendothelial hyperplasia or infiltrative diseases mediated through cytokines (Meyer and Twedt 2000). Splenomegaly is because of reactive lymphoid hyperplasia and concurrent extramedullary hematopoiesis (Egenvall et al. 2000). The sonographic change in gall bladder included distention with presence of sludge/clear bile which may be due to anorexia.

Conclusion

In this study, it was observed that hypo echogenicity of liver parenchyma with gall bladder distension was the

prominent USG finding in all the tick born intracellular diseases. Hepato-splenomegaly followed by presences of ascites and splenomegaly are the other USG finding. Correlating these USG finding with other laboratory examination will be very much use full to spot the diseases condition and organ involvement in tick born intracellular diseases of dog.

References

Adaszek L, Listos P, Gorna M, Zietek J, Capiga D (2009) Severe babesiosis in dog with cholestatic jaundice. Zycie Weter 84(3):227–230

Baneth G (2006) Hepatozoonosis. In: Greene CE (ed) Infectious diseases of the dog and cat, 3rd edn. Saunders, Philadelphia, pp 698–705

Carrade DD, Foley JE, Borjesson DL, Sykes JE (2009) Canine granulocytic anaplasmosis: a review. J Vet Intern Med 23:1129–1141

Eduardo F, Barreiro JD, Goicoa A, Espino L, Fraga G, Barreiro AS (2011) Abdominal ultrasonographic findings in dogs naturally infected with babesiosis. Vet Radiol Ultrasound 52(3):323–329

Egenvall A, Lilliehook I, Bjoersdorff A, Engvall EO, Karlstam E, Artursson K, Heldtander M, Gunnarsson A (2000) Detection of granulocytic *Ehrlichia* species DNA by PCR in persistently infected dogs. Vet Rec 146:186–190

Ganguly S, Mukhopadhayay SK (2008) Tick-borne Ehrlichiosis infection in human beings. Vector Borne Dis 45:273–280

Hildebrandt PK, Huxsoll DL, Walker JS, Nims RM, Taylor R, Andrews M (1963) Pathology of canine ehrlichiosis (Tropical canine pancytopenia). Am J Vet Res 34:1309–1320

Jacobson LS, Clark IA (1994) The pathophysiology of canine babesiosis: new approaches to an old puzzle. J S Afr Vet Assoc 65:134–145

Kohn B, Galke D, Beelitz P, Pfister K (2008) Clinical features of canine granulocytic anaplasmosis in 18 naturally infected dogs. J Vet Intern Med 22:1289–1295

Kumar A (2004) Clinico-therapeutic aspects of canine ehrlichiosis. M.V.Sc. Thesis, Indian Veterinary Research Institute, Izatnagar, India

Meyer DJ, Twedt DC (2000) Effect of extrahepatic disease on the liver. In: Bonagura JD (ed) Kirk's Current Veterinary Therapy XIII. WB Saunders, Philadelphia, pp 668–671

Mylonakis ME, Kritsepi-Konstantinou M, Dumler JS, Diniz PPVP, Day MJ, Siarkou VI, Breitschwerdt EB, Psychas V, Petanides T, Koutinas AF (2010) Severe hepatitis associated with acute *Ehrlichia canis* infection in a dog 24. J Vet Intern Med 3:633–638

Nyland TG, Mattoon JS (2002) Small Animal Diagnostic Ultrasound, 2nd edn. WB Saunders, Philadelphia

Sakuma S, Ishigaki T, Takeuchi T (1987) Diagnostic imaging of the liver, Biliary tract and pancreas. Data Analysis and Diagnostic Procedures. Springer-Verlag Berlin, pp 13–53