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Evaluation of Serum Lactate Dehydrogenase in Dogs with Hepatic and Splenic Tumours

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Abstract

The present study was undertaken to evaluate the diagnostic utility of serum lactate dehydrogenase (LDH) in dogs affected with hepatic and splenic tumours. Dogs presented to Madras Veterinary College Hospital, Chennai, with clinical signs suggestive of intra-abdominal neoplasia were subjected to detailed clinical examination, radiography, and ultrasonography. Cytological and histopathological examinations were performed for definitive diagnosis. Serum lactate dehydrogenase (LDH) activity was evaluated in 15 dogs with hepatic tumours, 15 dogs with splenic tumours, and 12 clinically healthy dogs used as controls for comparison. Serum LDH levels were significantly elevated in tumour-bearing dogs compared to healthy controls. However, no significant difference was observed between hepatic and splenic tumour groups. Among the hepatic and splenic tumour groups, dogs diagnosed with cholangiocellular carcinoma and splenic lymphoma, respectively, exhibited comparatively higher serum LDH concentrations than dogs affected with other tumour types. The findings suggest that serum LDH may serve as a useful biomarker for detecting intra-abdominal neoplasia in dogs, although its utility in differentiating tumour location appears limited.

Keywords: Lactate dehydrogenase, Hepatic tumours, Splenic tumours, Dog

Introduction

Lactate dehydrogenase (LDH) is an intracellular enzyme involved in anaerobic glycolysis and is released into circulation following cellular injury, tissue destruction, and neoplastic proliferation. Increased serum LDH activity has been reported in several human and animal malignancies and is considered an indicator of tumour metabolism and burden. Considering the limited information available regarding LDH concentrations in canine hepatic and splenic tumours, the present study was undertaken to evaluate serum LDH activity in dogs with hepatic and splenic neoplasms.

Materials and Methods

The study was conducted on 30 dogs diagnosed with intra-abdominal tumours, comprising 15 hepatic tumour cases and 15 splenic tumour cases presented to the Small Animal Medicine Outpatient Unit of Madras Veterinary College Teaching Hospital, Chennai. Twelve clinically healthy dogs were included as controls. All dogs were subjected to detailed clinical examination, hematobiochemical evaluation, radiography, and abdominal ultrasonography for tumour identification and localization (Fig 1- 4). Fine needle aspiration cytology (FNAC) was performed under ultrasonographic guidance using a 24-gauge needle attached to a disposable syringe. Aspirated material was smeared onto clean glass slides, air-dried, and stained with Giemsa stain for microscopic examination. For histopathological examination, tissue samples obtained by biopsy or surgical excision were fixed in 10 per cent neutral buffered formalin, processed routinely, sectioned at 4–5 µm thickness, and stained with haematoxylin and eosin (Fig 5- 6).

Results and Discussion

The mean ± standard error (SE) of serum lactate dehydrogenase (LDH) concentration in healthy control dogs was 99.67 ± 4.33 U/L, whereas dogs with hepatic tumours and splenic tumours exhibited significantly higher concentrations of 514.67 ± 24.14 U/L and 473.60 ± 32.58 U/L, respectively. Statistical analysis revealed a highly significant difference among the groups at the one per cent level ($P < 0.01$). The ultrasonographic findings in the present study revealed hepatomegaly, splenomegaly, heterogeneous masses, irregular margins, reticulated splenic parenchyma, and metastatic involvement in dogs with hepatic and splenic tumours. These observations are consistent with the findings of Kambala *et al*. (2026), who reported ultrasonography as a sensitive

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imaging modality for the detection and preliminary characterization of splenic neoplasms in dogs. The significant elevation of serum LDH activity observed in tumour-bearing dogs in the present study is consistent with the findings of Marconato *et al.* (2009), who reported significantly higher serum LDH concentrations in dogs with various malignancies compared to healthy controls. Similarly, Goodwin *et al*. (2019) highlighted the central role of lactate metabolism in tumour progression and reported that increased LDH activity is associated with tumour aggressiveness, angiogenesis, metastasis and poor prognosis. The elevated LDH concentrations recorded in dogs with hepatic and splenic tumours may be attributed to increased cellular proliferation, tissue hypoxia, tumour necrosis and membrane disruption resulting in leakage of intracellular enzymes into circulation. Likewise, Faloppi *et al.* (2014) reported that higher serum LDH concentrations were associated with poorer clinical outcomes in patients with hepatocellular carcinoma and suggested that LDH serves as a marker of tumour burden and biological aggressiveness. Although the mean LDH concentration was numerically higher in dogs with hepatic tumours than in dogs with splenic tumours, the difference was not statistically significant. This finding suggests that serum LDH reflects the presence and metabolic activity of neoplastic tissue rather than the anatomical location of the tumour. Similar observations were reported by Marconato *et al*. (2009), who noted considerable overlap in LDH values among different tumour types, thereby limiting its utility as a tumour-specific diagnostic marker.

Fig. 1. Dog showing distended abdomen

Fig. 2. Dog showing enlarged submandibular lymph nodes

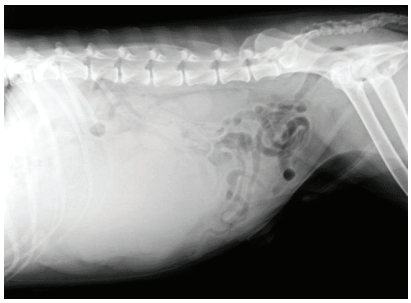

Fig. 3. Radiography revealed radiodense mass in the hepatic /spleen region

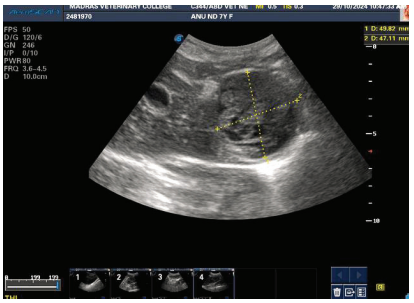

Fig. 4. Ultrasonography revealed heterogenous parenchymal mass in the left lobe of hepatic region.

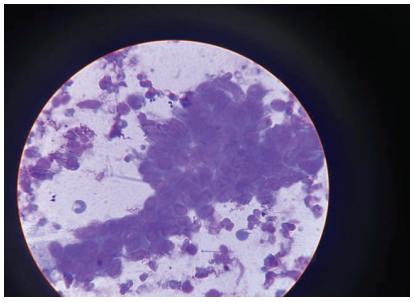

Fig. 5. Cytology of hepatic mass revealed cohesive cluster of epithelial cells with moderate to abdunant cytoplasm. Some degree of anisocytosis and anisokaryosis also noticed

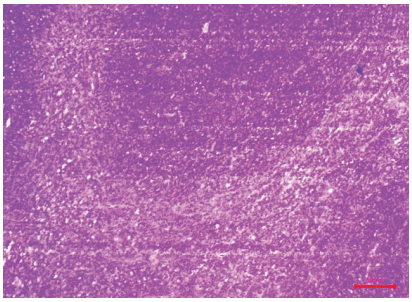

Fig. 6. Histopathology of splenic mass revealed revealed diffuse infiltration and replacement of the normal parenchyma by a dense population of neoplastic lymphoid cells.

Within the hepatic tumour group, dogs diagnosed with cholangiocellular carcinoma exhibited higher serum LDH concentrations than those affected with hepatocellular carcinoma. Similarly, within the splenic tumour group, dogs with splenic lymphoma showed comparatively higher serum LDH concentrations than dogs diagnosed with splenic haemangiosarcoma, histiocytic sarcoma, and haemangioma. This observation is in agreement with the findings of Zanatta *et al.* (2003), who reported significant elevations of LDH isoenzymes in canine lymphoma and observed shorter survival times in dogs with higher LDH concentrations. Furthermore, Bitencourt *et al*. (2026) documented significantly higher LDH levels in dogs with multicentric lymphoma and demonstrated that LDH concentrations decreased substantially following successful chemotherapy, indicating its close association with tumour burden and treatment response. Overall, the significant increase in serum LDH activity observed in dogs with hepatic and splenic tumours supports its potential utility as a marker of tumour-associated metabolic alterations and disease burden, although its value in differentiating tumour type or location appears limited.

References

Bitencourt, R. C., Garcia, M. F., Cabral, A. P. M., Gorenstein, T. G., Lesbon, J. C. C., Anai, L. A., Fukumasu, H., Horta, R. D. S., de Nardi, A. B. and Santana, A. E. 2026. Serum Lactate Dehydrogenase as a Biomarker of Disease Burden and Chemotherapy Response in Canine High-Grade Multicentric Lymphoma. *Vet. Sci.,* **13(1):** 93.

Faloppi, L., Scartozzi, M., Bianconi, M., Svegliati Baroni, G., Toniutto, P., Giampieri, R., Del Prete, M., De Minicis, S., Bitetto, D., Loretelli, C., D'Anzeo, M., Benedetti, A. and Cascinu, S. 2014. The role of LDH serum levels in predicting global outcome in HCC patients treated with sorafenib: implications for clinical management. *BMC cancer*., **14**:110.

Goodwin, M. L., Gladden, L. B., Nijsten, M. W. and Jones, K. B. 2015. Lactate and cancer: revisiting the warburg effect in an era of lactate shuttling. *Frontiers in Nutrition*, 1:27.

Kambala, S., Ramprabhu, R., Jeyaraja,K., Pazhanivel, N. and Arun Prasad, A. 2026. Radiographic and Ultrasonographic Features of Splenic Tumors in Dogs: A Clinicopathological Study. *Indian J. Anim. Res*., **1-7**. doi: 10.18805/IJAR.B-5812.

Marconato, L., Crispino, G., Finotello, R., Mazzotti, S., Salerni, F. and Zini, E. 2009. Serum lactate dehydrogenase activity in canine malignancies. *Vet. Comparative Oncol.,* **7(4)**: 236–243.

Zanatta, R., Abate, O., D'Angelo, A., Miniscalco, B. and Mannelli, A. 2003. Diagnostic and prognostic value of serum lactate dehydrogenase (LDH) and LDH isoenzymes in canine lymphoma. *Vet. Res. Communications*, **27(1):**449–452.

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