

Hemato-Biochemical Alterations Associated with Malignant Mammary Tumours in Canine

Aniruddha Banerjee, Md. Mofijul Islam, Malay Das,
Satyaki Chakrabarty, Subrata Chowdhury,
Sayantan Sarkar

Received 18 April 2018; Accepted 18 May 2018; Published on 6 June 2018

Abstract The present study conducted to determine the usefulness of hemato-biochemical study as a reliable prognostic factor in canine malignant mammary tumour. A total twenty-six (26) bitches aged 8-10 years with malignant mammary tumours were studied. Hematological parameters like hemoglobin (Hb), Packed Cell Volume (PCV), Total Erythrocyte Count (TEC) and Biochemical parameters viz. Se-

rum Total Protein (STP), Albumin, Globulin, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST) and Alkaline phosphatase (ALP) were calculated in Semi-Auto analyzer. The results showed a significant ($p < 0.01$) decrease level in Hb, PCV, TEC, STP and Albumin concentration. A significantly ($p < 0.01$) higher level were found in Alkaline phosphatase (ALP) and Globulin concentration. Based on the present study it can be concluded that Hemato-biochemical alteration in the bitches with malignant mammary tumour might serve as a parameter for the objective evaluation of understanding of the extent of effect of the tumour on the patient.

Keywords Hemato-Biochemical, Mammary tumour, Canine.

Introduction

Mammary tumour is one of the leading cause of death in pet animals. Simeonov and Stoikov (2006) reported that almost 81% of canine mammary tumours were malignant in nature. Spontaneous mammary tumours in dogs is closely similar with breast cancer, making them suitable comparative models (Munson and Moresco 2007). 5 years and older bitches are most frequently affected with this type of tumour (Murphy 2008). Dachshunds, Cocker Spaniels, German-Shepherds were reported to be increased risk of developing mammary tumours (Rutteman 1990). Canine mammary tumour are quite heterogenous in terms of morphology and biological behavior and most of them are often differenti-

Aniruddha Banerjee*
Department of Veterinary Pathology, West Bengal University
of Animal and Fishery Sciences, Kolkata 700037,
West Bengal, India
e-mail : aniruddhabanerjee58@gmail.com

Md. Mofijul Islam
Department of Veterinary Anatomy and Histology, West Bengal
University of Animal and Fishery Sciences, Kolkata 700037,
West Bengal, India

Malay Das
Department of Veterinary Public Health and Epidemiology,
Central Agricultural University, Aizawl 796014, Mizoram, India

Satyaki Chakrabarty
Department of Veterinary Microbiology, Central Agricultural
University, Aizawl 796014, Mizoram, India

Subrata Chowdhury
Department of Animal Nutrition, West Bengal University of
Animal and Fishery Sciences, Kolkata 700037,
West Bengal, India

Sayantan Sarkar
Department of Veterinary Surgery and Radiology,
West Bengal University of Animal and Fishery Sciences,
Kolkata 700037, West Bengal, India

*Corresponding author

ated into bone, cartilage, and fat which is not uncommon in human breast cancer (Misdorp 2002). Presently surgical excision of primary tumour masses is the sole form of treatment. One of the major problems in veterinary oncology is post-surgical prognosis of mammary tumour cases. Hemato-biochemical assessment provided useful prognostic information in human breast cancer (Jaffe et al. 1968, O'Reilly et al. 1990). The aim of the present article to investigate the usefulness of hemato-biochemical study as a reliable prognostic factor in canine malignant mammary tumour.

(Authors are grateful to Vice-Chancellor, West Bengal University of Animal and Fishery Sciences; Dean, Faculty of Veterinary and Animal Sciences, WBUAFS and concerned Heads of the Department of Veterinary Pathology, Department of Veterinary Surgery and Radiology, WBUAFS, Kolkata, India for providing necessary facilities to do research work).

Materials and Methods

Place and period of the study

This entire study was conducted in laboratory of the

Department of Veterinary Pathology having the required facilities. The investigation was carried out for one year, i.e. from December 2016 to November 2017.

Selection of animals

A total twenty-six (26) bitches aged 8-10 years with malignant mammary tumours were studied. All patients were excluded from the study if they had received previous treatment was not a curative attempt. In surgically removed samples, the mammary tumours were exercised by simple mastectomy. Tissue samples were collected in 10% neutral buffered formalin. Sections were cut at 5µm thick and routinely stained with hematoxylin and eosin for histological examination (Luna 1972). Canine mammary tumours were identified according to the World Health Organization (WHO) criteria, based on predominant histopathological lesions observed in 50% of the tumour masses (Misdorp 1999). Most of the malignant mammary tumours were simple tubular adenocarcinoma. Tumour showed predominantly tubular component with central lumen formation (Fig. 1). Nuclear pleomorphism and mitotic activity was moderate. Neoplastic cells were deeply infiltrative,

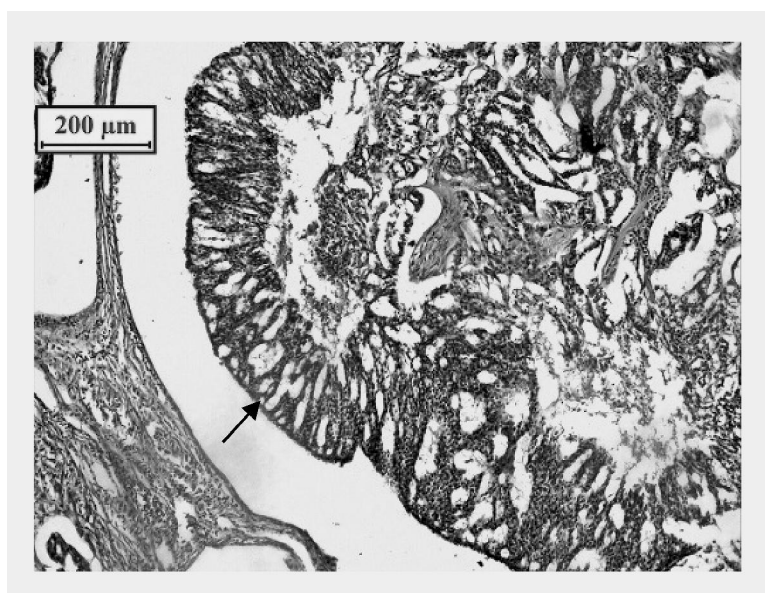


Fig. 1. Simple Tubular Adenocarcinoma of Mammary Gland was characterized by tubular arrangement (arrow) of neoplastic cells. The lining of the tubules was 1 to 2 cells thick, H and E, X100.

often appeared as single or small group of cells in desmoplastic matrix (Goldschmidt et al. 2011).

Hemato-biochemical studies

About 5ml of blood from each dog with malignant mammary tumour was carefully drawn by cephalic vein puncture. Similarly, 5ml of blood also collected from 6 healthy bitches for healthy control. Hematological parameters like Hemoglobin (Hb), Packed Cell volume (PCV), Total Erythrocyte Count (TEC) were calculated as described by Jain (1986). Biochemical parameters viz. Serum Total Protein (STP), Albumin, Globulin, Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST) and Alkaline phosphatase (ALP) in Semi-Auto analyzer (Biosystem BTS350).

Statistical analysis

All the data were statistically analyzed by unpaired t-test. The significance (p value) was recorded at 1% level ($p < 0.01$). Statistical analysis of collected data was performed using statistical software (Graph Pad Prism 3.00; Graph Pad Software, San Diego, California, USA).

Results and Discussion

The hemato-biochemical values of the bitches with malignant mammary tumours were analyzed (Table 1) and the results showed a significant ($p < 0.01$) decrease level in Hb, PCV, TEC. This decline in level of Hb, PCV and TEC is attributed to some cytokines Tumour Necrosis Factor (TNF)- α , Interleukin (IL)-1, Interleukin (IL)-6 and Interferon (IFN)- γ which are made by tumour cells (Strassmann et al 1992, Langstein et al. 1991). TNF- α inhibits hemoglobin production by down regulating GATA-1 and reduce Erythropoietin (Epo) induced erythropoiesis (Buck et al. 2009). TNF- α indirectly inhibit proliferation of erythroid progenitors by triggering nuclear factor (NF)- $\kappa\beta$ and GATA-2 pathways (Morceau et al. 2009).

This study revealed significant ($p < 0.01$) decrease in serum value of total protein and albumin. Significant decrease in total protein and albumin may

Table 1. Blood profile and serum enzyme values in dogs (Mean \pm SE).

Parameters	Control (6 animals)	Test (26 animals)	p value
Hb (g/dl)	12.55 \pm 0.51	8.5 \pm 0.027	$p < 0.01$
PCV (%)	38.36 \pm 1.23	26.0 \pm 0.79	$p < 0.01$
TEC (10^6 /ml)	5.76 \pm 0.23	3.6 \pm 0.08	$p < 0.01$
ALT (U/L)	48.46 \pm 4.02	30 \pm 4.04	$p < 0.01$
AST (U/L)	28.76 \pm 2.78	27 \pm 3.32	$p < 0.01$
ALP (U/L)	38.42 \pm 2.92	84 \pm 4.83	$p < 0.01$
STP (g/dl)	6.41 \pm 0.019	7.6 \pm 0.05	$p < 0.01$
Albumin (g/dl)	3.85 \pm 0.01	1.5 \pm 0.022	$p < 0.01$
Globulin (g/dl)	2.56 \pm 0.08	6.1 \pm 0.029	$p < 0.01$

be attributed to cachexia-associated with cancer. Mider et al. (1950) reported that albumin concentration varied inversely with the stage of malignancy. Steinfeld (1960) postulated that an increase in albumin catabolism with failure of the body to synthesize sufficient albumin to keep pace with the demand of the cancer and the host for this protein. Brenner et al. (1990) reported that TNF- α lead to decrease albumin gene transcription in mice. Serum globulin concentration is directly related to tumour progression. Suga and Tamura (1992) reported that concomitant increase in both α_1 and α_2 globulin were observed in patient with advanced gastric cancer.

In present study, serum Alkaline Phosphatase (ALK) level were found significantly ($p < 0.01$) higher in dogs with malignant mammary tumours. O'Reilly et al. (1990) also reported that total serum alkaline phosphatase was elevated in 76% patients with liver metastases from breast cancer. Moss (1982) reported that an increase level of liver alkaline phosphatase in patient with malignant neoplasms caused by malignant infiltration of the liver and secondary deposition in bone also produced an osteoblastic response, with an increase in bone alkaline phosphatase in serum.

Conclusion

Large number of diagnostic modalities available and marker has been identified for accurate and prompt diagnosis, but all requires ultramodern laboratory and also expensive one. Based on the present study it can be concluded that Hemato-biochemical alter-

ation in the bitches with malignant mammary tumours might serve as a parameter for the objective evaluation of understanding of the extent of effect of the tumour on the patient.

References

- Brenner DA, Buck M, Feitelberg SP, Chojkier M (1990) Tumor necrosis factor-alpha inhibits albumin gene expression in a murine model of cachexia. *The J Clinical Invest* 85:248—255.
- Buck I, Morceau F, Grigorakaki C, Dicato M, Diederich M (2009) Linking anemia to inflammation and cancer : The crucial role of TNF α . *Biochem pharmacol* 77 : 1572-1579.
- Goldschmidt M, Pena L, Rasotto R, Zappulli V (2011) Classification and grading of canine mammary tumors. *Vet pathol* 48 : 117-131.
- Jaffe BM, Donegan WL, Watson F, Spratt JJ (1968) Factors influencing survival in patients with untreated hepatic metastases. *Surgery, Gynecology and Obstetrics* 127 : 1-11.
- Jain NC (1986) Schalm's Veterinary hematology. 4th edit, Lea and Febeger, Philadelphia.
- Langstein HN, Doherty GM, Fraker DL, Buresh CM, Norton JA (1991) The roles of γ -interferon and tumor necrosis factor α in an experimental rat model of cancer cachexia. *Cancer Research* 51 : 2302—2306.
- Luna LG (1972) Manual of histologic staining methods of the Armed Forces Institute of Pathology (3rd ed). Mc Graw-Hill Book company, New York, pp 38—39.
- Mider GB, Alling EL, Morton JJ (1950) The effect of neoplastic and allied diseases on the concentrations of the plasma proteins. *Cancer* 3 : 56—65.
- Misdorp W (1999) Histological classification of the mammary tumors of the dog and the cat. World Health Organization International Histological Classification of Tumors of Domestic Animals Second Series 7 : 1—59.
- Misdorp W (2002) Tumours of the mammary gland. In Meuten DJ (ed). *Tumours in domestic animals*, 4th edit. Iowa State Press, Iowa, pp 575—606.
- Morceau F, Dicato M, Diederich M (2009) Pro-inflammatory cytokine-mediated anemia : Regarding molecular mechanisms of erythropoiesis. *Mediators of inflammation* 2009.
- Moss DW (1982) Alkaline phosphatase isoenzymes. *Clinical Chem* 28:2007—2016.
- Munson L, Moresco A (2007) Comparative pathology of mammary gland cancers in domestic and wild animals. *Breast Disease*. 28 : 7—21.
- Murphy S (2008) Mammary tumours in dogs and cats. In *Practice* 30:334—339.
- O'Reilly SM, Richards MA, Ruben RD (1990) Liver metastases from breast cancer : The relationship between clinical, biochemical and pathological and features and survival *Europ J cancer and Clinical Oncology* 26 : 574—577.
- Rutteman GR (1990) Hormones and mammary tumour disease in the female dog : An update. *In vivo* (Athens, Greece) 4 : 33—40.
- Simeonov R, Stoikov D (2006) Study on the correlation between the cytological and histological tests in the diagnostics of canine spontaneous mammary neoplasms. *Bulg J Vet Med* 9:211—219.
- Steinfeld JL (1960) 1131 albumin degradation in patients with neoplastic diseases. *Cancer* 13 : 974—984.
- Strassmann G, Fong M, Kenney JS, Jacob CO (1992) Evidence for the involvement of interleukin 6 in experimental cancer cachexia. *The J Clinical Investigation* 89 : 1681—1684.
- Suga S, Tamura Z (1972) Analysis of serum protein changes in patients with advanced gastric cancer with special reference to α -globulin fractions. *Cancer Res* 32 : 426—429.