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Clinical Utility of Lactate in Calves with Bovine Respiratory Disease

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Abstract: The aim of this study was to evaluate the clinical utility of lactate level in calves with Bovine Respiratory Diseases (BRD). About 28 calves with bronchopneumonia (trial group) and 20 healthy (control group) were used in this study. While 18 calves in the trial group recovered, 10 of them died in the first 24 h. It was determined that plasma lactate values of these 10 animals were significantly higher ($p<0.01$) than those of the recovered ones. Consequently, it has been concluded that the level of plasma lactate measurements in calves with BRD is a helpful prognostic parameter in veterinary practice.

Key words: Calf, BRD, lactate, analyser, clinical utility, Turkey

INTRODUCTION

Bovine Respiratory Disease (BRD) is a respiratory disease complex that accounts for a significant portion of cattle/calf losses as well as medication costs, labor and lost production in the beef and dairy industry. BRD in beef calves is called shipping fever, because the greatest incidence of bronchopneumonia occurs after shipment to stocker operations or feedlots. The main cause of BRD illness in calves is the tremendous exposure to infectious agents along with stress associated with weaning, commingling, and transportation. Multiple agents are often involved in the development of BRD. There factor of stress (especially transport), viral agents (PI3, IBR, BVD, BRSV, etc.) and bacterial agents (*Pasteurella*, *Haemophilus*, *Actinomyces*, *Mycoplasma* and *Chlamydia* sp., Mycobacterium, other) are almost always involved in cases of severe disease (Bowland and Shewen, 2000; Snowder *et al*., 2006).

The anaerobic metabolic pathway known as glycolysis is the first step of glucose metabolism and occurs in the cytoplasm of virtually all cells. The end-product of this pathway is pyruvate is metabolized by the enzyme lactate dehydrogenase to lactate. Its concentration in blood is determined by the relative rates of production and metabolism. The ability of the liver to consume lactate is concentration-dependent and progressively decreases as the level of blood lactate increases. Lactate uptake by the liver also is impaired by several other factors, including acidosis, hypoperfusion and hypoxia (Franklin and Peleso, 2006; Kaneko *et al*., 1997). The measurement of blood lactate to assess and monitor exercise performance is a common practice in sports physiology. Elevated lactate level is frequent in critically ill patients and clinical disorders such as shock, severe sepsis, endotoxemia, hepatic failure (Franklin and Peleso, 2006). Blood lactate concentration has become a common practice in animal medicine. Hyperlactatemi has been associated with a higher mortality rate among dogs in an intensive care unit and among horses with colic. Lactate has been reported as a predictor of gastric necrosis in dogs with gastric dilatation volvulus (De Papp and Drobatz, 1999). Blood lactate concentrations have been measured in healthy calves and found to be between 5-20 mg dL^{-1} (Kaneko *et al*., 1997). The aim of this study was to evaluate the clinical use of determination the plasma lactate level in calves with BRD.

MATERIALS AND METHODS

A total of 48 Holstein calves at various ages were used in this study; they were 20 healthy calves (control group) and 28 with bronchopneumonia (trial group). All calves were examined for routine clinical examination including primarily respiratory system and haematology, serology (BIO K 028 Respiratory Pentavalent kit and Flockcheck PM) and faeces. All calves were defined as bronchopneumonia caused by BRD-complex based on history, clinical signs and serology. About 8 mL of blood samples from each calve was collected in tubes

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containing anticoagulant (Na-EDTA) and they were centrifuged for 10 min at 3000 cycles min^{-1} and lactate analysis were performed on the plasma samples by using enzymatic photometric method (uv1202 spectrophotometer, Shimadzu). For treatment of the sick calves, Enroflaksasin (Baytril max® Bayer), Meloksikam (Maxicam® Sanovel), vitamine C (Vit-C® Sanovel) were used.

Statistical differences between groups were determined by Tukey test after carrying out one-way analysis of variance (ANOVA) using SPSS 10.0 software (Sokal and Rohlf, 1995).

RESULTS AND DISCUSSION

Among calves in the trial group, it was observed nasal discharge, dyspnoea, cough, decreased appetite and depression and mean rectal temperature was 40.8±0.8°C, mean respiratory rate was 55-80 min^{-1}, mean heart rate was 90-110 min^{-1}; whereas these values were in normal limits comparing with calves in the control group. About 12 out of 28 treatment administered calves recovered while 10 died within 24 h. Statistically significant difference ($p<0.01$) was established among the plasma lactate levels of the calves which recovered, died and control group (Table 1).

Apart from the size of the problem, respiratory disease is important because it can adversely affect other systems of the body. BRD causes increased death loses as well as medication coasts, labour and lost production. In this reason, veterinary practitioners need reliable and accurate diagnostic and/or prognostic tests. Lactate is a good indicator of severity of diseases.

The increase in plasma lactate values is a reliable indicator of oxygen deficit in tissues. It is an important criterion in determination of the level of circulatory insufficiency which occurs in various diseases and the prognosis in an expeditious manner (Coghe *et al*., 2000; Fauchere *et al*., 2002). It is suggested that determination of plasma lactate level may be very helpful in the monitoring and prognosis of patients in intensive care (Deshpande and Ward-Platt, 1997; Husain *et al*., 2003). It was concluded that hyperlactatemia would develop in deaths due to septic and hypovolemic shock, mesenteric infarction, traumatic injuries and acute myocardial infarct (Bernardin *et al*., 1996; Lange and Jackel, 1994).

It was reported that determining plasma lactate level would be helpful also in monitoring horses with colic, dogs with gastric dilatation and anaesthesia (Ebert, 1994; De Papp and Drobatz, 1999). Furthermore, Brown *et al.* (1996) exhibited that a release of lactate from lungs occurs in patients with sepsis and acute respiratory distress syndrome. It is reported that lactate levels higher than 36 mg dL^{-1} in cattle with respiratory problem (Coghe *et al*., 2000) and 40 mg dL^{-1} in dogs with babesiosis (Nel *et al*., 2004) is an indicator of very poor prognosis. In this study, the average plasma lactate levels of the calves died in 24 h were also found to be high (40 mg dL^{-1}) as stated by Nel *et al.* (2004) and Coghe *et al.* (2000).

Table 1: Plasma lactate level in healthy, recovered and dead animals

Animals	N	Average	Min (mg dL^{-1})	Max (mg dL^{-1})
Healthy	20	10.51±2,5[a]	7.1	13.2
Recovered	18	19.33±7,1[b]	15.3	34.1
Dead	10	40.81±6,52[c]	36.4	43.8

There is a significant difference ($p<0,01$) between groups marked with different letters. ±: Standard Deviation

CONCLUSION

As a consequence, it is concluded that the plasma lactate value is a helpful parameter for clinicians in evaluation of diagnosis and prognosis in cattle with BRD.

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