

Changes in cardiac markers in a calf died of foot and mouth disease

Case Report

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ABSTRACT

This report disclosed changes in cardiac troponin expression during myocardial degeneration in a calf with foot and mouth disease (FMD). The case presented was a 7-day-old calf milk fed by its mother which diagnosed as having FMD (O-type) by Ministry of Agriculture and Forestry Şap (Foot and Mouth Disease) Institute. The calf suffered from myocarditis due to suckling FMD infected dam. Blood sample was taken from the jugular vein of calf. Serum cTn-T, cTn-I, CK-MB, LDH, AST and ALT levels were measured using commercial kits. cTn-T, cTn-I, CK-MB, LDH, AST and ALT levels were determined as 1.00 ng/mL, 26.68 ng/mL, 262 U/L, 4503 U/L, 56.6 U/L, 55.3 U/L, respectively and these values were higher than those of healthy calf. It is thought that the use of cardiac troponins (cTn-I, cTn-T) for the diagnosis of the disease will give accurate and rapid results.

Keywords: Calf, CK-MB, cTn-I, cTn-T, FMD.

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INTRODUCTION

Foot and Mouth disease (FMD) an acute, contagious viral disease of ruminants causes serious economic losses (Kitching et al., 2007; AlSaad, 2020). The course of the disease depends on factors such as the entry site, strain, and type of host (Barnett and Cox, 1999; Hughes et al., 2002). The incubation period varies between 2-14 days (Alexandersen et al., 2003). Infected animals spread the virus through secrete and excrete (Çiftçi and İnanç, 2017). FMD causes sudden death due to myocardial degenerations in young and sensitive calves (Gülbahar et al., 2007). While the morbidity rate of the disease can reach 100%, the mortality rate is 1-2% in adults and 20% in young animals (Lubroth, 2002; Çiftçi and İnanç, 2017; Aly et al., 2020).

In recent years, cardiac troponins (cTn) have widely been used in veterinary cardiology, as they have a high sensitivity and specificity for myocardial damage (El-Khuffash and Molloy, 2008; Tunca et al., 2009; Undhad et al., 2012; AlSaad, 2020). Troponin consists of three subunits: troponin I (cTn-I), troponin T (cTn-T), and troponin C. In humans, cTn-I has been considered more sensitive and specific than cTn-T (Rajappa and Sharma, 2005). It has been reported that cardiac troponin level is more sensitive than creatinine kinase myocardial band (CK-MB) (Ooi et al. 2000). Moreover, creatine kinase (CK) and CK-MB levels are at their normal values during the onset of myocardial damage, while cTn-I levels increase significantly. This leads to wide use of troponins for diagnostic purposes (Bayraktar, 2014).

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In this case report, changes in cTn-I, cTn-T, CK-MB, lactate dehydrogenase (LDH), aspartate aminotransferase (AST) and alanine aminotransferase (ALT) values of a calf died due to myocarditis resulting from FMD were investigated and the results were evaluated.

CASE HISTORY

Foot and Mouth disease cases in cattle were recorded and immediately quarantine was implemented in Akyaka district of Kars province by Kars Agriculture and Forestry Directorate on 31.01.2022. A 7-day-old calf was referred with clinical signs of lethargy, dyspnea. The history revealed that the calf was suckling its mother with clinical signs of FMD and sample taken from udder by the Provincial Directorate of Agriculture and Forestry disclosed FMD (O variant) positive by PCR analysis at the Ministry of Agriculture and Forestry Foot and Mouth Disease Institute. The rectal temperature of the calf was 40.1°C, the pulse rate was 119 beats/min, and the respiratory rate was 42 breaths/min. Arrhythmia was also detected on cardiac auscultation. There were no vesicular or erosive lesions of FMD. These findings were in accordance to those related myocardial form of FMD (Dawood and Alsaad, 2018). Following physical examination, 8 mL blood sample without anticoagulant was taken from jugular vein in order to determine serum cTn-I, cTn-T, CK-MB, LDH, AST and ALT concentrations. The calf died on the following day of sampling. A blood sample was taken from another healthy calf under the same care and feeding conditions in order to make comparisons. Samples were stored at room temperature for one hour and centrifuged at 3000 rpm for 15 minutes, then harvested serum was stored at -20 °C until analysis. cTn-I, cTn-T and CK-MB were measured using commercial kits (BT LAB, China for cTn-T and ELK Biotechnology, P.R.C for cTn-I, CK-MB) on ELISA reader (ELISA reader®-DAS for cTn-I and Elecsys® 2010-Roche for cTn-T,

CK-MB). LDH, AST and ALT activities were measured on a fully automatic autoanalyzer device (Roche, Cobas C501). The data obtained from the case was made available with the permission of the owner through signed informed consent form.

Table 1. Serum cTn-I, cTn-T, CK-MB LDH, AST and ALT levels in healthy and diseased calf.

Parameters	Healthy	Patient
cTn-I (ng/mL)	0.16	26.7
cTn-T (ng/mL)	0.018	1.00
CK-MB (U/L)	17.88	262.0
LDH (U/L)	341.60	895
AST (U/L)	27.13	56.6
ALT (U/L)	18.90	8.1

Abbreviations: cTn-T=Cardiac Troponin T, cTn-I=Cardiac Troponin I, CK-MB: Creatine phosphokinase, LDH: Lactate Dehydrogenase, AST: Aspartate aminotransferase, ALT: Aspartate transaminase.

The cTn-I, cTn-T, CK-MB, LDH, AST and ALT values of healthy calves and calves that died of myocardial form of Foot and Mouth disease are presented in Table 1. Accordingly, cTn-I, cTn-T, CK-MB, LDH and AST values were higher than healthy calves except for ALT which was higher in healthy calf.

DISCUSSION

Foot and Mouth disease, is of great importance due to high economic losses incurred by disease. The most important clinical sign of Foot and Mouth disease is vesicle formation in mouth and foot (Windsor et al., 2011). However, in the myocarditis form, death usually occur before vesicle formation (Lubroth, 2002). For this reason, early diagnosis as well as prevention is of great importance (Sobrinho et al., 1986; Çiftçi and İnanç, 2017).

In a study conducted on beef cattle with FMD, cTn-I analysis was reported to be sensitive and specific to detect myocardial degeneration and a threshold value of ≥ 3.618 ng/mL for cTn-I was recommended to determine myocardial degeneration and also reported higher cTn-I and LDH levels in calves

with FMD when compared with healthy calves (Akin et al., 2015).

In another study, cTn-T, cTn-I, LDH levels in healthy calves were reported as 0.344 ng/mL, 0.03 ng/mL, 959.02 U/L, respectively, and increased in premature calves (Aydoğdu et al., 2016). Similarly the cTn-I, LDH, AST and ALT levels of calves with foot and mouth were reported significantly higher (Tunca et al., 2008; Cha et al., 2017; Salim et al., 2019; Aly et al, 2020). In this case report, the cTn-T, cTn-I, CK-MB, LDH, AST and ALT levels of the calf with myocarditis were 1.00 ng/mL, 26.68 ng/mL, 262.0 U/L, 4503 U/L, 56.6 U/L, 55.3 U/L, respectively. These values were higher than those of healthy calves.

As a result; Foot and Mouth disease is still a major problem due to myocardial form that causes sudden death without clinical symptoms in young animals, despite massive vaccination campaigns. Therefore, early diagnosis of the disease is important. It is thought that the use of cardiac troponins (cTn-I, cTn-T) for the diagnosis of disease-related myocardial degeneration will give accurate and rapid results.

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Ethical approval:

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