Elevated serum concentration of cardiac troponin I in a Dorcas gazelle (Gazella dorcas) with mitral vegetation

ARTICLE *in* COMPARATIVE CLINICAL PATHOLOGY · MARCH 2014

Impact Factor: 0.37 · DOI: 10.1007/s00580-013-1847-9

4 AUTHORS, INCLUDING:

Mohamed Tharwat

Qassim University

123 PUBLICATIONS **340** CITATIONS

SEE PROFILE

Fahd Al-Sobayil

Deanship of Graduate Studies - Qassim Uni…

82 PUBLICATIONS **222** CITATIONS

SEE PROFILE

Comp Clin Pathol (2014) 23:469–473
DOI 10.1007/s00580-013-1847-9

BRIEF COMMUNICATION

Elevated serum concentration of cardiac troponin I in a Dorcas gazelle (*Gazella dorcas*) with mitral vegetation

M. Tharwat · F. Al-Sobayil · A. Al-Hawas · S. Buczinski

Received: 12 April 2013 / Accepted: 4 November 2013 / Published online: 21 November 2013

Abstract A 15-month-old male Dorcas gazelle (*Gazella dorcas*), with a history of weight loss, anorexia, fever, and lethargy of 2 weeks' duration was examined. The gazelle showed several symptoms of illness including fever, lethargy, and tachycardia. The serum cardiac troponin I (cTnI) was as high as 2.18 ng/ml then dropped to 0.09 ng/ml after treatment. Transthoracic echocardiography revealed 1.02×1.37 cm irregular vegetation located on the left atrioventricular valve compatible with mitral endocarditis. This is the first report showing mitral vegetation in a gazelle associated with increased cTnI concentration and its recovery.

Keywords Cardiac biomarkers · Cardiac troponin I · CK-MB · Endocarditis · Gazelle

Place of the work The work was performed at the Veterinary Teaching Hospital, College of Agriculture and Veterinary Medicine, Qassim University.

M. Tharwat · F. Al-Sobayil · A. Al-Hawas
Department of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Qassim University, Qassim, Saudi Arabia

F. Al-Sobayil
e-mail: fsobayil@hotmail.com

A. Al-Hawas
e-mail: wahm-999@hotmail.com

S. Buczinski
Bovine Ambulatory Clinic, Departement des Sciences Cliniques, Faculté de Médecine Vétérinaire, Université de Montréal, Saint-Hyacinthe, Canada
e-mail: s.buczinski@umontreal.ca

Present Address:
M. Tharwat (✉)
Department of Animal Medicine, Faculty of Veterinary Medicine, Zagazig University, Zagazig, Egypt
e-mail: mohamedtharwat129@gmail.com

Introduction

In companion or wild animal species, endocarditis is not common (Robinson and Maxie 1993), whereas in bovines it is (Tharwat and Buczinski 2011; Buczinski et al. 2012; Buczinski et al. 2013). Animals typically present with chronic infectious process, undulating fever, and heart murmur (Bexiga et al. 2008), but specific signs of cardiac disease with signs of heart failure are present in only 33 % of the cases (Buczinski et al. 2012).

Cardiac troponins, especially cardiac troponin I (cTnI), are highly sensitive and specific markers of myocardial injury in veterinary medicine as we have recently reported (Tharwat et al. 2012; Tharwat et al. 2013a, b, c, d). To the authors' knowledge, endocarditis has not been reported in gazelles. This report describes the recovery of a Dorcas gazelle (*Gazella dorcas*) with left atrioventricular heart valve vegetation that has been associated with increased concentration of serum cTnI.

Materials and methods

The gazelle (15-month-old, BW 22 kg, body condition score 3.25) was presented for a thorough examination at the Veterinary Teaching Hospital, Qassim University, Saudi Arabia. Based on a 1 to 5 scale, the body condition score of the gazelle was determined using a previously described protocol in goats using lumbar vertebral palpation (Mcgregor and Butler KL 2008). The admitted gazelle was reared with other five gazelles that were kept in a free stall private farm. All gazelles were vaccinated against pasteurellosis and enterotoxaemia 2 months earlier. According to the history, the diseased gazelle had been febrile and lethargic for 2 weeks before admission, and had been treated unsuccessfully with extensive intravenous fluid therapy, procaine penicillin, and gentamicin for 6 days. When first examined, the rectal temperature was 40.7 °C (reference range; 39.6–40.8 °C), the heart rate was

130 bpm (reference range; 80–120 bpm) and the respiratory rate was 55 breaths/min (reference range; 20–40 breaths/min). The mucous membranes were pale with a capillary refill time of >3 s. Cardiac auscultation revealed a low-grade systolic murmur with a point of maximal intensity on the left side of the thorax. The rumen was hypomotile (one contraction per 3 min). No other abnormalities were observed on physical examination.

Echocardiography

To investigate the origin of the murmur, the gazelle was prepared for a standard echocardiography as reported in goats (Steininger et al. 2011; Leroux et al. 2012). The left and right sides of the thorax were clipped and shaved from the third to the fifth intercostal space and a coupling gel was then applied. Cardiac ultrasonography was then performed with a 7.5 MHz sectorial probe (SSD-500, Aloka, Tokyo, Japan).

Treatment

Starting on the same day of admission, treatment consisted of parenteral glucose injection (250 ml glucose 10 % IV twice daily for five successive days). Based on blood culture results, antibiotic was selected in response to susceptibility to vancomycin HCl. The antibiotic (Vancolon, Julphar, Gulf Pharmaceutical Industries, UAE) was injected initially at a dose of 20 mg/kg followed by 15 mg/kg slowly administered intravenously every 12 h for 16 days. On admission to the hospital, a single dose of dexamethasone (20 mg) (Dexasone, Riyadh, Saudi Arabia) was injected IM. Following the day of dexamethasone injection, a non-steroidal anti-inflammatory drug, Flunixin meglumine (Finadyne, Schering-Plough Animal Health, USA), was administered in a dose of 2.2 mg/kg IM for the following five successive days. The appetite had greatly improved 1 week after treatment. The gazelle was discharged from our clinic on day 22 after admission and the owner was advised to continue injecting the antibiotic intramuscularly for the following 3 weeks.

Hematology and serum biochemistry

A 10-ml blood sample was obtained by jugular venipuncture using sterile vacutainers. Three milliliter of the sample, collected into an EDTA tube, were used for hematological tests, and the remaining 7 ml, placed in plain tubes, were used to obtain serum for biochemical parameters. Hematological examinations (total and differential leukocyte count, red blood cells, hemoglobin, and hematocrit) were carried out using an automated analyzer (VetScan HM5, Abaxis, CA, USA). In the serum, the concentrations of total protein, albumin, globulin, blood urea nitrogen, calcium, magnesium, and phosphorus were determined. The serum activity of alkaline phosphatase (ALP), γ-glutamyl transferase, aspartate aminotransferase (AST), and creatine kinase (CK) were also measured (VetScan VS2, Abaxis, CA, USA).

Cardiac troponin I and creatine kinase myocardial band assays

The serum samples were thawed immediately before analysis and analyzed on the same morning for cTnI using a point-of-

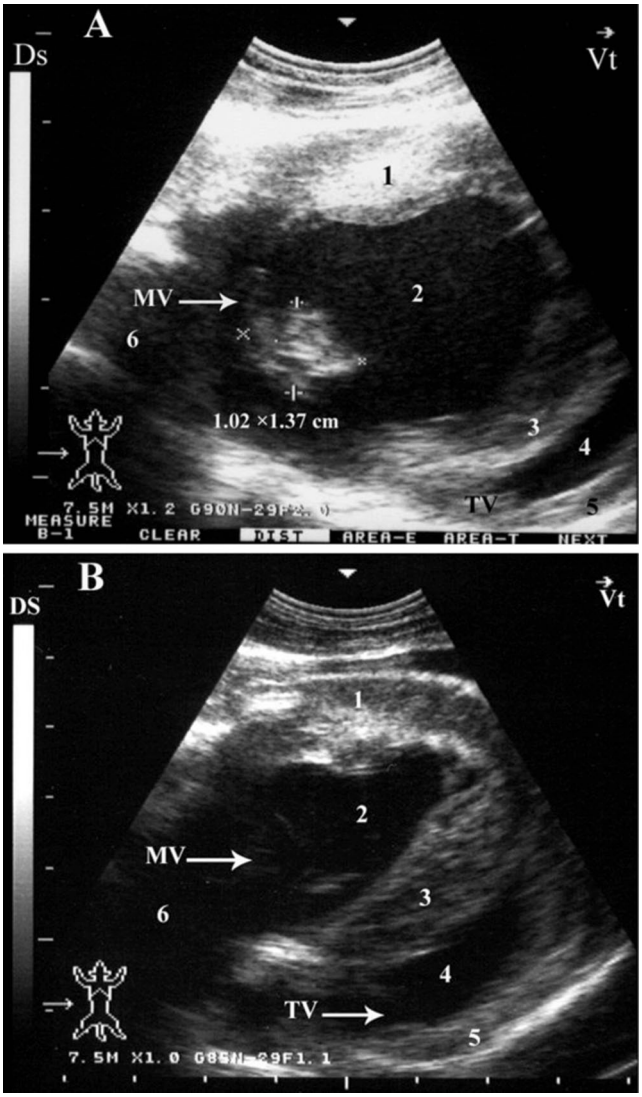

Fig. 1 Left parasternal caudal long-axis view of the left and right ventricles together with the atrioventricular valves in a Dorcas gazelle. Image **a** shows a mitral vegetation of 1.02×1.37-cm thickness (*arrow*). Image **b** shows the same image in **a**, but after 18 days, when no vegetation was detected (*arrow*). *1* left ventricular wall, *2* left ventricle, *3* interventricular septum, *4* right ventricle, *5* right ventricular wall, *6* left atrium (*MV* mitral valve, *TV* tricuspid valve, *Ds* dorsal, *Vt* ventral)

care analyzer (VetScan i-STAT 1, Abaxis, CA, USA). The i-STAT cTnI test cartridge uses a two-site enzyme-linked immunosorbent assay method. The lower limit of detection of cTnI for this assay is 0.01 ng/ml. The CK-MB mass measurements were performed using an electrochemiluminescent assay (Cobas 6000 C501, Roche Diagnostics, Indianapolis, IN, USA). The lower limit of detection of CK-MB for this assay is 0.1 ng/ml. Because no reference ranges for cTnI have been established in gazelles, blood samples from the five clinically healthy gazelles within the same group were collected for determination of serum cTnI and CK-MB concentration as well as other hematological and biochemical parameters.

Results and discussion

The echocardiographic findings were in accordance with a vegetation of the mitral valve. The valve was irregularly thickened with a dilation of the left ventricle (Fig. 1a). No myocardial anomalies were observed. Hematology findings included leukocytosis, monocytosis, neutrophilia, and severe anemia. The serum biochemistry profile showed hypoproteinemia, hypoalbuminemia, hypophosphatemia, and increase serum activity of ALP, AST, and CK (Table 1).

Before treatment, the serum cTnI and CK-MB concentrations of the gazelle were 2.18 and 0.61 ng/ml, respectively. After cessation of the antibiotic injection treatment, the gazelle was returned for a follow-up examination. The serum concentration of cTnI had declined to 0.09 ng/ml (control values 0.06±0.02 ng/ml, Table 1). Interestingly, when echocardiography was carried out, no vegetation was found on the mitral valve, the valve leaflets were smooth, and no dilation of the left ventricle was imaged (Fig. 1b). The serum CK-MB concentration of the gazelle decreased to 0.34 ng/ml after treatment (0.50±0.09 ng/ml in the controls). The CBC and biochemical findings returned to within control values (Table 1). Follow-up telephone calls 30 and 90 days after cessation of the treatment revealed that the gazelle had made a full recovery.

To the authors' knowledge, endocarditis has not been reported in gazelles. In bovines, the clinical findings in cases of endocarditis include a chronic infectious process, intermittent fever, tachycardia, and heart murmur (Tharwat and Buczinski 2011; Buczinski et al. 2013), although those signs lack specificity (Reef and Mcguirk 2008). In addition, no chronic

Table 1 Hematological and biochemical variables in a Dorcas Gazelle with mitral vegetation compared to healthy controls

Variables	Before treatment	After treatment	Controls ($n=5$)	
			Mean	SD
White blood cells ($\times10^9$/l)	20.0	8.3	10.4	3.9
Lymphocytes ($\times10^9$/l)	13.1	5.0	9.4	3.0
Monocytes ($\times10^9$/l)	1.60	0.10	0.06	0.02
Neutrophils ($\times10^9$/l)	6.9	1.6	2.0	0.5
Lymphocytes (%)	65.2	59.7	81.5	1.2
Monocytes (%)	19.8	0.5	0.5	0.0
Neutrophils (%)	34.3	19.2	18.1	1.2
Red blood cells ($\times10^{12}$/l)	4.0	10.5	11.0	0.2
Hemoglobin (g/dl)	9.4	15.9	16.4	1.8
Hematocrit (%)	16.0	28.0	33.5	5.3
Total protein (g/l)	51.0	68.0	66.6	1.3
Albumin (g/l)	29.0	35.0	43.2	1.8
Globulin (g/l)	22.0	33.0	23.4	2.1
Alkaline phosphatase (U/l)	204	159	119	43
Aspartate aminotransferase (U/l)	276	150	101	32
γ-glutamyl transferase (U/l)	50	51	51	16
Creatine kinase (CK) (U/l)	4,471	257	278	163
Blood urea nitrogen (mmol/l)	8.3	4.6	7.6	1.8
Calcium (mmol/l)	2.4	3.3	2.6	0.1
Phosphorus (mmol/l)	1.25	2.55	2.34	0.38
Magnesium (mmol/l)	0.86	0.89	1.18	0.09
Cardiac troponin I (ng/ml)	2.18	0.09	0.06	0.02
CK-myocardial band (ng/ml)	0.61	0.34	0.50	0.09

inflammatory process was detected in the case reported here. A cardiac murmur has been detected on physical examination in 50 to 80 % of confirmed cases of endocarditis (Bexiga et al., 2008). In the present case, a low-grade systolic murmur was heard while auscultating the heart, especially on the left side of the thorax. In cattle, transthoracic echocardiography is a sensitive tool for the antemortem detection and localization of endocarditis; findings include an irregular valvular thickening, and the infected endocardium is usually echogenic (Tharwat and Buczinski 2011; Buczinski et al. 2013).

Cardiac troponin I is a valuable indicator of myocardial cell necrosis and ischemia (Ladenson 2007; Tharwat et al. 2013a, b, c, d). The potential value of the cTnI concentration has been reported in many animal species (Holbrook et al. 2006; Varga et al. 2009) pointing to its important role in assessing myocardial dysfunction. Increased cTnI concentrations in cases of endocarditis have been observed frequently in humans (Watkin et al. 2004), cattle with endocarditis (Mellanby et al. 2009; Buczinski and Bélanger 2010), and in a calf with myocarditis (Karapinar et al. 2010), but have never been reported in other species. A recent study demonstrated that an increased concentration of cTnI in cases of infective endocarditis was correlated with the presence of annular or myocardial abscesses diagnosed by echocardiography (Purcell et al. 2008).

In humans with endocarditis, the cTnI assessment could serve as a prognostic tool, where elevated cTnI is associated with the composite of death, abscess, and central nervous system events. Patients with infective endocarditis and increased cTnI concentration are also more likely to have left ventricular systolic dysfunction. In human medicine, cTnI has been shown to be both highly sensitive and specific for cardiomyocyte damage (Baker et al. 2011). The unique aspect of cTnI being 100 % tissue specific for the heart makes it an excellent marker to serve as a biochemical tool for detecting myocardial injury. The continuing cellular release and clearance of cTnI account for its excellent diagnostic sensitivity (Baker et al. 2011).

In conclusion, this is the first report documenting the usefulness of transthoracic echocardiography for the diagnosis of mitral vegetation in a gazelle and its follow up and recovery. It is also the first to show an increased cTnI level in a gazelle with mitral endocarditis and its role in the prognosis of this case.

Acknowledgments The authors thank N. Peachy, Professor of English, Qassim University, Saudi Arabia, for language revisions.

References

Baker JO, Reinhold J, Redwood S, Marber MS (2011) Troponins: redefining their limits. Heart 9:47–452

Bexiga R, Mateus A, Philbey AW, Ellis K, Barrett DC, Mellor DJ (2008) Clinicopathological presentation of cardiac disease in cattle and its impact on decision making. Vet Rec 162:575–580

Buczinski S, Bélanger A (2010) Bovine tricuspid endocarditis as a cause of increased serum concentration of cardiac troponins. Can Vet J 51: 195–197

Buczinski S, Tsuka T, Tharwat M (2012) Bacterial endocarditis in cattle, a meta-analysis of published cases from 1973 to 2011. Vet J 193:349–357

Buczinski, S, Tolouei, M, Rezakhani, A, Tharwat, M (2013) Echocardiographic measurement of cardiac 1 valvular thickness in healthy cows, cows with bacterial endocarditis, and cows with cardiorespiratory diseases. J Vet Cardiol. In press. Doi.org/10.1016/j.jvc.2013.08.001

Holbrook TC, Birks EK, Sleeper MM, Durando M (2006) Endurance exercise is associated with increased plasma cardiac troponin I in horses. Equine Vet J 36:27–31

Karapinar T, Dabak DO, Kuloglu T, Bulut H (2010) High cardiac troponin I plasma concentration in a calf with myocarditis. Can Vet J 51: 397–399

Ladenson JH (2007) A personal history of markers of myocyte injury (myocardial infarction). Clin Chim Acta 381:3–8

Leroux AA, Moonen ML, Farnir F, Sandersen CF, Deleuze S, Salciccia A, Amory H (2012) Two-dimensional and M-mode echocardiographic reference values in healthy adult Saanen goats. Vet Rec 170:154

Mcgregor BA, Butler KL (2008) Relationship of body condition score, live weight, stocking rate, and grazing system to the mortality of Angora goats from hypothermia and their use in the assessment of welfare risks. Aust Vet J 86:12–17

Mellanby RJ, Henry JP, Cash R, Ricketts SW, Bexiga R, Truyers I, Mellor DJ (2009) Serum cardiac troponin I concentrations in cattle with cardiac and noncardiac disorders. J Vet Int Med 23:926–930

Purcell JB, Patel M, Khera A, De Lemos JA, Forbess LW, Baker S, Cabell CH, Peterson GE (2008) Relation of troponin elevation to outcome in patients with infective endocarditis. Am J Cardiol 101:1479–1481

Reef VB, Mcguirk SM (2008) Diseases of the cardiovascular system. In: Smith BP (ed) Large Animal Internal Medicine, 4th edn. Missouri: Elsevier-Saunders, St. Louis, pp 453–489

Robinson WF, Maxie MG (1993) The cardiovascular system. In: Jubb JBF, Kennedy PC, Palmer N (eds) Pathology of domestic animals, 4th edn. Academic, New York, pp 24–27

Steininger K, Berli AS, Jud R, Schwarzwald CC (2011) Echocardiography in Saanen-goats: normal findings, reference intervals in awake goats, and the effect of general anesthesia. Schweiz Arch Tierheilkd 153:553–564

Tharwat M, Buczinski S (2011) Clinicopathological findings and echocardiographic prediction of the localization of bovine endocarditis. Vet Rec 169:180

Tharwat M, Al-Sobayil F, Al-Sobayil K (2012) The cardiac biomarkers troponin I and CK-MB in nonpregnant and pregnant goats, goats with normal birth, goats with prolonged birth, and goats with pregnancy toxemia. Theriogenology 78:1500–1507

Tharwat M, Al-Sobayil F, Buczinski S (2013a) Influence of racing on the serum concentrations of the cardiac biomarkers troponin I and creatine kinase myocardial band (CK-MB) in racing greyhounds. Vet J 197:900–902

Tharwat M, Al-Sobayil F, Buczinski S (2013b) Cardiac biomarkers changes in camels (*Camelus dromedarius*) secondary to long road transportation. J Vet Cardiol 15:15–22

Tharwat M, Al-Sobayil F, Buczinski S (2013c) Effect of racing on the serum concentrations of cardiac troponin I and creatine kinase myocardial band in racing camels (*Camelus dromedarius*). Vet Res Commun 37:139–144

Tharwat M, Al-Sobayil F, El-Sayed M (2013d) Cardiac troponin I in healthy newborn goat kids and in goat kids with cardiac nutritional muscular dystrophy. Acta Vet Hung 61:442–453

Varga A, Schober KE, Holloman CH, Stromberg PC, Lakritz J, Rings DM (2009) Correlation of serum cardiac troponin I and myocardial damage in cattle with monensin toxicosis. J Vet Int Med 23:1108–1116

Watkin RW, Lang S, Smith JM, Eliott TS, Littler WA (2004) Role of troponin I in active infective endocarditis. Am J Cardiol 94:1198–1199