Theriogenology 82 (2014) 800–806

Contents lists available at ScienceDirect

Theriogenology

journal homepage: www.theriojournal.com

Influence of stimulation by electroejaculation on myocardial function, acid–base and electrolyte status, and hematobiochemical profiles in male dromedary camels

M. Tharwat [1,*], A. Ali, F. Al-Sobayil, R. Derar, A. Al-Hawas

Department of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Qassim University, Saudi Arabia

ARTICLE INFO

Article history:
Received 1 April 2014
Received in revised form 22 May 2014
Accepted 10 June 2014

Keywords:
Acid–base
Blood gases
Camel
Cardiac troponin I
Electroejaculation

ABSTRACT

This study was carried out to evaluate the effect of electroejaculation (EEJ) on myocardial function, acid–base balance, and hematobiochemical profiles in male dromedary camels. Twenty sexually mature, apparently healthy male camels were assigned to EEJ. Parallel, eight naturally mated male camels were enrolled as a control group. Three blood samples were collected from each camel: just before (T0), directly after (T1), and 24 hours after (T2) EEJ or natural mating. The serum concentrations of the cardiac biomarker troponin I (cTnI), blood gas parameters, and hematobiochemical profiles were determined. Nineteen camels were ejaculated by the end of the second circuit and one by the end of the first circuit. In both groups, the mean heart and respiratory rates had increased significantly immediately after the procedure, but returned to normal values 24 hours after the procedure. The mean serum concentration of cTnI had increased significantly in all camels after EEJ, but not in controls. However, at 24 hours post-EEJ, the serum concentration of cTnI did not differ significantly compared with baseline values. The blood pH and base excess had decreased, and the PCO_2 and lactic acid had increased after EEJ. The EEJ provoked decreases in hematocrit and mean corpuscular volume. In the control group, the base excess, HCO_3^-, TCO_2, anion gap, and lactic acid increased slightly after mating but did not reach a significant level compared with premating values. It is concluded that EEJ in camels results in a reversible myocardial injury, changes in the acid–base status, and increase the lactic acid concentration.

1. Introduction

Artificial vagina and electroejaculation (EEJ) are the two methods used to obtain semen from camels [1]. The sexual behavior of the male camel and the stance during copulation make the process of semen collection using an artificial vagina an exhausting technique; hence, an electroejaculator is widely used to collect semen in this species. However, the latter technique has raised concerns and implications in the area of animal welfare. The effects of EEJ include behavioral patterns in the animals such as vocalizing, struggling, or displaying strong muscular contractions [2]. In humans, EEJ without anesthesia is known to be painful [3], and complications such as nausea and vomiting, elevated blood pressure, and headaches have been reported [4]. Similarly in animals, EEJ is reported to be painful and stressful [1,5–8].

In human medicine, there has been a push for the discovery of novel cardiac biomarkers to aid in the early detection, diagnosis, and prognosis of cardiac diseases [9]. Among these biomarkers, cardiac troponin I (cTnI) is a highly sensitive and specific marker for myocardial injury in humans [10–12] and in veterinary medicine [13–16]. The

* Corresponding author. Tel.: +966500960421; fax: +96663801360.
E-mail address: mohamedtharwat129@gmail.com (M. Tharwat).
[1] Permanent address: Department of Animal Medicine, Faculty of Veterinary Medicine, Zagazig University, Egypt.

0093-691X/$ – see front matter © 2014 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.theriogenology.2014.06.023

cTnI is a protein found in the myocardial cell that initiates tropomyosin contraction [13–15,17–20]. Its serum concentration elevates after acute myocardial injury because of leakage from the damaged myocardial cells [19]. The degree of increase in cTnI has been shown to correlate with the extent of myocardial damage and with survival in humans [21] and in animals [16,22–28].

The effects of EEJ on myocardial function, acid–base balance, and blood gases have not been reported in veterinary literature. The present study was therefore designed to evaluate the effect of EEJ on myocardial function in male dromedary camels, as assessed by cTnI, and to evaluate the influence of EEJ on acid–base balance, blood gases, and hematobiochemical profiles.

2. Materials and methods

2.1. Camels

The experimental protocol was approved by the Ethics Committee for Animal Research of the Scientific Research Deanship of Qassim University, Saudi Arabia. The study was carried out on a group of 20 sexually mature, healthy male dromedary camels. Animals were presented to the Veterinary Teaching Hospital, Qassim University, for assessment of fertility soundness. The camels were between 6 and 18 years of age and weighed 450 to 870 kg, with body condition scores ranging from 3.5 to 4.5 on a scale of 1 to 5 [29]. In addition, eight naturally mated camels (age: 8.5–13.0 years; weight: 620–780 kg; body condition score: 3.5–4.0) were used as a control group. All the camels were considered healthy on the basis of physical examination (auscultation of the heart, lungs, rumen, and intestine and measurement of heart and respiratory rates) and laboratory evaluation (normal complete blood cell counts and biochemistry panel). The animals were treated according to the regulations of the Laboratory Animal Control Guidelines of Qassim University, which basically conform to the Guide for the Care and Use of Laboratory Animals of the National Institutes of Health (NIH) in the United States (NIH publications Nos. 86–23, revised 1996).

2.2. Electroejaculation

Before EEJ, each camel was positioned in a lateral recumbancy as described previously [30]. The animal was then restrained physically with ropes and slightly sedated with xylazine HCl (0.2 mg/kg body weight, iv, Bomazine 10%, BOMAC Laboratories Ltd, New Zealand). An iv jugular catheter was then inserted. Before EEJ, the feces were evacuated from the rectum.

The electroejaculator (ElectroJac 6, Neogen, Lexington, KY, USA) was adjusted on the automatic mode, where the circuit delivers a series of 40 cycles, with each cycle delivering a slightly higher intensity. Each cycle lasts 2 seconds, followed by a 2-second pause. The stimulators were operated on a power source of 220 volts and 40 cycles alternate current. The voltage to the probe was regulated by two control knobs. The power step control regulated the maximum voltage to the probe in seven increments (power steps) ranging from 10 to 40 volts. Within each power step, a bull was stimulated by turning the stimulator knob smoothly from zero to the maximum voltage, then back to zero, over a period of 2 to 3 seconds. The voltage was then increased to the next higher power step and the process was repeated. Once ejaculation had begun, no further increase in voltage was used unless it was judged necessary to obtain a complete ejaculate.

2.3. Blood sampling

Three blood samples were collected from each camel: the first just before EEJ (T0), the second directly after EEJ (T1), and the third at 24 hours after EEJ (T2). Parallel, in the control group, blood samples were collected just before mating (T0), directly after mating (T1), and at 24 hours after mating (T2). From both experimental and control groups, 10 mL of jugular blood was collected at each sampling time: 2 mL in EDTA tubes for hematological analyses, 2 mL in heparinized tubes for the determination of blood gas parameters, and the remaining 6 mL in plain tubes to obtain serum for the determination of cTnI and other biochemical analytes. The blood gas, hematology, serum biochemistry, and cTnI assays were performed immediately after blood sampling.

2.4. Blood gas analyses

The heparinized blood samples were used immediately to analyze the acid–base and blood gas parameter values *in situ* using a portable clinical veterinary analyzer (I-STAT, Abaxis, CA, USA). In this way, blood pH, partial pressure of carbon dioxide (PCO_2), partial pressure of oxygen (PO_2), bicarbonate (HCO_3^-), total carbon dioxide (TCO_2), base excess (BE), oxygen saturation (SO_2), sodium, potassium, chloride, and lactate were analyzed immediately in order to prevent changes in the concentrations of these parameters [31].

2.5. Cardiac troponin I assay and validation of cTnI intraassay repeatability

The test that was used for the study to detect cTnI was a commercial portative test (I-Stat, cTnI, VetScan, Abaxis), using a two-site enzyme-linked immunosorbant assay. We had recently validated the assay for the detection of camel cTnI [26], and it had been proven effective for the detection of camel cTnI [24–28]. The lower limit of detection of cTnI for this assay was 0.02 ng/mL. The i-STAT cTnI test reports 0.00 to 50.00 ng/mL. Samples above the reportable range will yield more than 50.00 ng/mL on the analyzer display screen. However, the performance characteristics of the i-STAT cTnI measurement have not been established for cTnI values above 35.00 ng/mL. Values less than0.02 ng/mL cannot be discriminated, although the analyzer provides a specific point estimate of 0.00, 0.01, or 0.02 ng/mL. All results are expressed as nanograms per milliliter with interassay CV of less than 5%. The intraassay repeatability was performed using sera from 27 healthy camels and 9 camels with various disorders (cardiomyopathy ($n = 3$), renal abscess ($n = 2$), ruptured urinary bladder ($n = 2$), intestinal obstruction ($n = 1$), and ruptured urethra ($n = 1$)