Small Ruminant Research 117 (2014) 73–77

Contents lists available at ScienceDirect

Small Ruminant Research

journal homepage: www.elsevier.com/locate/smallrumres

Cord and jugular blood acid–base and electrolyte status and haematobiochemical profiles in goats with naturally occurring pregnancy toxaemia

Mohamed Tharwat*, Fahd Al-Sobayil

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

ARTICLE INFO

Article history:
Received 23 July 2013
Received in revised form 8 December 2013
Accepted 10 December 2013
Available online 18 December 2013

Keywords:
Acid–base
Blood gases
Cord blood
Goat
Jugular blood
Pregnancy toxaemia

ABSTRACT

This study was carried out to investigate umbilical cord and jugular blood acid–base and electrolyte status and haematobiochemical profiles in goats with normal parturition and in those with naturally occurring pregnancy toxaemia (PT). Fifty does, divided into two groups, were used. The first, control group, was comprised of 20 clinically healthy pregnant does. The second, diseased group consisted of 30 pregnant does suffering from PT. Jugular and umbilical vein blood samples were collected from each doe. In both samples, blood gas parameters including pH, partial pressure of carbon dioxide (PCO_2), oxygen partial pressure (PO_2), bicarbonate (HCO_3), total carbon dioxide (TCO_2), base excess (BE), oxygen saturation (SO_2), sodium, potassium, chloride and lactate were determined immediately after collection. Compared to the jugular blood values in the controls, the blood pH, PO_2, BE, HCO_3, TCO_2 and SO_2 were lower in the goats with PT ($P < 0.01$). However, the PCO_2 and anion gap were higher ($P < 0.05$). Compared to values in the cord blood of the controls, the blood pH, PO_2, SO_2, BE, HCO_3 and TCO_2 were lower in the goats with PT ($P < 0.01$), although the PCO_2, anion gap, potassium and lactate were significantly higher ($P < 0.05$). The jugular and cord blood acid–base and electrolyte status and haematological and biochemical profiles in this study could be used as a reference for goats with normal birth and in goats with PT.

1. Introduction

Pregnancy toxaemia (PT) is a metabolic condition characterised by hypoglycaemia and hyperketonaemia resulting from inability of the animal to maintain an adequate energy balance (Rook, 2000). The disease has a significant economic impact on sheep and goat enterprises due to loss of foetuses, veterinary costs and loss of the dam balance (Rook, 2000). Predisposing causes include stress and food deprivation or negative energy balance in late pregnancy that results in a glucose deficiency (Rook, 2000; Van Saun, 2000; Kulcsár et al., 2006). The resulting hypoglycaemia produces excessive lipomobilisation and, as a consequence, ketone bodies appear in the blood (Andrews, 1997). About 60% of foetal growth takes place in this last gestation period (Twardock et al., 1973), and during this time, approximately 33–36% of the circulating glucose is directed into the foetoplacental unit in order to satisfy its energetic demands (Hay et al., 1983).

In humans, cordocentesis is a prenatal diagnostic test which directly accesses the umbilical cord vasculature, permitting foetal blood to be analysed antenatally. The procedure may be performed to help diagnose a number of concerns such as malformations of the foetus, foetal infection, foetal platelet count in the mother, foetal anaemia and isoimmunisation (Tongprasert et al., 2010; Collins

* Corresponding author. Permanent address: Department of Animal Medicine, Faculty of Veterinary Medicine, Zagazig University, Egypt. Tel.: +966 500960421.
E-mail address: mohamedtharwat129@gmail.com (M. Tharwat).

0921-4488/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.smallrumres.2013.12.026

and Impey, 2012). Estimation of the umbilical cord blood pH and blood gas values provide valuable information regarding the status of the infant at birth; base excess determination quantifies the magnitude of metabolic acidosis, the putative risk factor for central neurological injury (Westgate et al., 1994; Thorp et al., 1996; Nageotte and Gilstrap, 2009).

The diagnosis of clinical PT is based on history, clinical signs of hepatic encephalopathy, and the results of serum biochemical analyses (Ingraham and Kappel, 1988). In severe outbreaks, morbidity rates can reach up to 20%, with 80% mortality in affected animals (Andrews, 1997; Rook, 2000). Early detection of PT in susceptible animals is therefore essential for successful treatment (Ismail et al., 2008). It has been reported recently that experimentally induced PT in goats can be detected early by measuring acid–base changes in the blood (González et al., 2012). This study was designed to investigate the umbilical cord blood *versus* jugular blood acid–base and electrolyte status and haematobiochemical profiles in goats with naturally occurring PT in a step towards understanding of pathophysiological changes that occur in this species.

2. Materials and methods

2.1. Animals and clinical examination

The experimental protocol was approved by the Animal Ethical Committee, Deanship for Scientific Research, Qassim University, Saudi Arabia. Fifty does, divided into two groups, were used. The first, control group (age; 22.9 ± 8.7 mo; weight 43 ± 10 kg), was comprised of twenty clinically healthy pregnant does that had a normal parturition. The second diseased group consisted of thirty pregnant does (age; 22.7 ± 6.9 mo; weight 58.4 ± 15.4 kg). They were referred to our clinic because of anorexia and recumbancy during the last days of pregnancy. No treatment intervention was attempted and the course of the disease varied from 24 to 96 h.

Both groups were examined clinically including the determination of general behaviour and condition, auscultation of the heart, lungs, rumen and intestine, measurement of heart rate, respiratory rate and rectal temperature. The goats were maintained in a free-stall barn and kept under 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 in the USA (NIH Publications No. 86 to 23, revised 1996).

2.2. Blood sampling

From each doe with PT, 10 mL jugular blood sample was collected just before hysterotomy, and a similar volume of blood was collected from the umbilical vein of during the operation. Of the twenty control does, jugular and cord blood samples were collected at the time of parturition with caesarean section. During hysterotomy, the does in both groups were anaesthetised by injecting lidocaine HCl 2% (2.5 mg/kg) (Pharmaceutical Solutions Industry, Jeddah, Saudi Arabia) using either linear or inverted L infiltration local anaesthesia in the left flank. Of both jugular and cord blood samples in the diseased and control goats, 2 mL were collected in EDTA tubes for haematological analyses, 2 mL in heparinised tubes for blood gas analyses, and the remaining 2 mL in plain tubes to obtain serum for the determination of the biochemical analytes.

2.3. Blood gas analyses

The heparinised blood samples were used immediately to analyse the acid–base and blood gas parameter values *in situ* using a portable clinical veterinary analyser (i-STAT®, Abaxis, California, USA). In this way, blood pH, partial pressure of carbon dioxide (PCO_2), oxygen partial pressure (PO_2), bicarbonate (HCO_3), total carbon dioxide (TCO_2), base excess (BE), oxygen saturation (SO_2), sodium, potassium, chloride and lactate were analysed immediately in order to prevent changes in the concentrations of these parameters as reported (Gokce et al., 2004).

2.4. Haematology and serum biochemistry

Haematological examinations [total and differential leucocyte count, red blood cells (RBC), haemoglobin, haematocrit, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC)] were carried out using an automated analyser (VetScan HM5, Abaxis, California, USA). The serum samples were used to determine the concentrations of total protein, albumin, globulin, blood urea nitrogen (BUN), calcium, glucose, magnesium and phosphorus. The serum activity of alkaline phosphatase (ALP), γ-glutamyl transferase (GGT), aspartate aminotransferase (AST) and creatine kinase (CK) was also measured. An automated biochemical analyser (VetScan VS2, Abaxis, California, USA) was used for the measurement of the above-mentioned serum parameters. The serum concentrations of β-hydroxy butyric acid (BHBA) were determined photometrically using commercial kits (Human Gesellschaft fur Biochemica und Diagnostica, Wiesbaden, Germany).

2.5. Statistical methods

Data are presented as means ± standard deviation, and the analysis was conducted using SPSS program software (2009). Blood gases and haematobiochemical parameters in the jugular and cord blood of the diseased goats and of the controls were compared using Student's *t* test, and the significance was set at $P < 0.05$.

3. Results

In the control group, the mean rectal temperature was 38.8 ± 1.2 °C (reference range: 38.6–40.2 °C), the mean heart rate was 77 ± 12 beats per minute (bpm) (reference range: 70–90 bpm) and the mean respiratory rate was 26 ± 9 breaths per minute (bpm) (reference range: 20–30 bpm). In the diseased goats, hypothermia was found in 15 does (mean rectal temperature 37.2 ± 1.5 °C), bradycardia in 13 (mean heart rate 53 ± 8 bpm) and