

Diagnostic and Prognostic Value of Blood Gases and Acid Base Balance in Uterine Torsion in Buffaloes (*Bubalus Bubalis*)

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ABSTRACT

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Uterine torsion represents a serious complication of pregnancy and has been reported as a state of clinical emergency that may lead to potentially fatal systemic disturbances if untreated promptly. Therefore, the present study was carried out to clinically evaluate uterine torsion with special reference to the diagnostic and prognostic value of blood gases and acid base balance. A total number of 20 cases of uterine torsion in buffaloes were investigated in this study. Heparinized blood samples were collected to perform blood gases and acid base balance and complete blood picture, and serum samples were used for analysis of some biochemical parameters including serum total protein, glucose and liver enzymes (AST and ALT). Results of the present study revealed that affected buffaloes suffered from various degrees (mild, 90°, moderate 120-180°, severe 270° and very severe > 270°) of uterine torsion, significant increase in body temperature and heart rate in cases associated with septic uterus. Right-sided uterine torsion was reported in 18 cases while only 2 cases showed left-sided direction. The results of blood gases and acid base balance in 17 affected buffaloes with non septic uterus showed moderate to severe metabolic alkalosis with or without partial compensation. On the other hand, long-term complicated cases, septic uterus, (emphysematous fetus, cyanosed uterine wall, and putrefied uterine discharge) showed severe acidosis of metabolic origin. Complete blood count (CBC) of the affected buffaloes suggested two abnormalities: microcytic hypochromic anemia and leucocytosis accompanied by granulocytosis. Biochemical analysis revealed significant ($P < 0.05$) increase in the serum levels of AST and ALT. Hypoproteinemia is a consistent finding in affected buffaloes while serum glucose level showed a non consistent pattern of change. The present study suggested that, uterine torsion adversely affects the blood gases and acid base homeostasis. Acidosis seems to be associated with complicated cases (septic uterus) and may be an indication of poor prognosis. Attention should be made for corrections of blood gases and acid base alteration before and after detorsion to improve the outcomes of uterine torsion.

القيمة التشخيصية والتنبؤية لغازات الدم والاتزان الحمضي القاعدي في الإلتواء الرحمي في الجاموس

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تعتبر حالات الإلتواء الرحمي من الحالات المرضية الحرجة في الجاموس والتي يجب التعامل معها لضبط المتغيرات الدموية السريعة والتي ينتج عنها نفوق الحيوان. وعليه استهدفت الدراسة الحالية إلي التقييم الاكلينيكي للإلتواء الرحمي في الجاموس مع اشارة خاصة للقيمة التشخيصية للاتزان الحمضي القاعدي وغازات الدم. أجريت هذه الدراسة علي عدد ٢٠ حالة من حالات الإلتواء الرحمي في الجاموس متفاوتة الحدة. تم أخذ عينات دم علي ماع التخنتر-هيارين- لتحديد مستويات غازات الدم ومؤشرات التوازن الحمضي القاعدي وصورة الدم الكاملة، كما أخذ عينات مصل لتحليل بعض المعايير البيوكيميائية كالزلال الكلي لمصل الدم ، والجلوكوز وإنزيمات الكبد (AST & ALT). أظهرت نتائج هذه الدراسة بأن الجاموس عانت من درجات متفاوتة من الإلتواء الرحمي تراوحت بين شديدة ومعتدلة وبسيطة وارتفاعا ملحوظ في درجة حرارة جسم الحيوان ومعدلات ضربات القلب في الحالات المصاحبة بتسمم الرحم. سجلت الدراسة اتجاه الإلتواء الرحمي ناحية اليمين في عدد ١٨ حالة بينما حالتين فقط كان اتجاه الإلتواء الرحمي ناحية الشمال. أظهرت نتائج تحليل الدم لعدد ١٧ حالة ارتفاع معنوي ($p < 0.05$) في مستويات الأس الهيدروجيني وايون البيكربونات والشق القاعدي مع تغيرات في مستويات ضغط ثاني أكسيد الكربون بالدم بالزيادة كعملية تعويضية لارتفاع الأس الهيدروجيني بالدم. بينما في الحالات المصاحبة بتسمم الرحم (عدد ٣ حالات) أظهرت النتائج انخفاض معنوي ($p < 0.05$) في مستويات الأس الهيدروجيني وايون البيكربونات والشق القاعدي ولم تظهر النتائج تغيرات في مستويات ثاني أكسيد الكربون. كما أظهرت صورة الدم تغيرات معنوية في حجم كريات الدم الحمراء وتركيز الهيموجلوبين بالخلية كما أظهرت تغيرات معنوية في عدد كريات الدم البيضاء مصحوب بزيادة معنوية في كريات الدم البيضاء المحببة. التحليل البيوكيميائي أظهر زيادة معنوية في مستويات الزلال الكلي لمصل الدم ، وإنزيمات الكبد بينما أظهر جلوكوز الدم نمط غير ثابت من التغيير. الدراسة الحالية اقترحت بأن الإلتواء الرحمي يؤثر سلبا على غازات الدم والاتزان الحمضي القاعدي. تبدو حموضة الدم مرتبطة بالحالات المعقدة (تسمم الرحم) وقد تكون إشارة سلبية علي مصير حالات الإلتواء الرحمي. يمكن الخلاصة إلى انه يجب الإنتباه لتصحيح المتغيرات الدموية المصاحبة لحالات الإلتواء الرحمي في الجاموس لتحسين نتائج تعديل الإلتواء.

Key words: Acid base balance, Torsion, Buffaloes.

INTRODUCTION

Uterine torsion has been reported as a state of clinical emergency that needs a prompt medical intervention (Radostits, *et al.*, 2007). It represents a severe complication of pregnancy and has been reported as a serious cause of dystocia and potentially fatal systemic disturbances in all domesticated animals (Frazer *et al.*, 1996; Aubry *et al.*, 2008; Noakes *et al.*, 2009; Nanda *et al.*, 2003; Ali *et al.*, 2011; Amin *et al.*, 2011). While there is no enough data on the rate of fetal and maternal mortalities due to uterine torsion (Ali *et al.*, 2011), twisting of gravid uterus has been implicated as a frequent cause of fetal and dam deaths during breeding season resulting in severe economic losses to livestock producers.

A diverse list of predisposing factors has been suggested, including the unstable anatomical

arrangement of the gravid uterus, lack of dam movement during the last trimester stage of pregnancy and the energetic movements of the fetus during the first stage of labor; however the etiopathogenesis of the condition is not fully understood. It is well known that parturition in such cases is definitely impossible and circulatory disturbances can result in death of both the fetus and dam if a prompt diagnosis and correction are not made (Frazer *et al.*, 1996).

Additionally to physical distress associating with uterine torsion, the hemodynamic disturbances due to occlusion of major blood vessels and potentially development of endotoxemic shock (Pearson, 1971; Roberts, 1986; Arthur *et al.*, 1989) present several challenges to veterinarian for formulating a suitable therapeutic regime beyond the correction of the torsion. Moreover, post-correction care measures; in particular to

hemodynamic status should be taken into consideration to obtain a good outcome of this condition. Therefore, medical evaluation including clinical and laboratory assessment of such condition before initiating a physical (rolling) or surgical (caesarian section) correction is a key factor in making proper diagnostic and prognostic decisions.

While several studies have been conducting to explore the etiology of uterine torsion (Roberts, 1986; Frazer *et al.*, 1996; Schonfelder and Sobiraj, 2005; Ali *et al.*, 2011; Arthur *et al.*, 1989) little were done to investigate the systemic disturbance associated with this condition in particular, blood gases and acid base balance.

Against this background, the present study was carried out to clinically assess the uterine torsion and find a simple relationship between severity of uterine torsion and degree of alteration in the indices of blood gases and acid base balance in Egyptian buffaloes. Haematological and some other biochemical indices would also be considered.

MATERIALS and METHODS

Animals

A total number of 20 clinical cases of Egyptian buffaloes (*Bubalus bubalis*) (5.59 ± 1.4 years) suffering from uterine torsion were included in this study during spring season 2011. All cases were admitted to the Veterinary Teaching Hospital (VTH) at Assiut University- Egypt with a history of dystocia and inappetence of varying duration. Uterine torsion was diagnosed after a careful clinical examination at the VTH. Six healthy adult buffaloes were taken as a control in this study.

Clinical assessment

All animals were subjected to thorough clinical examination according to the method of Rosenberger (1979). Special attention was taken to the followings:

1. Stage of gestation (during pregnancy or at term),
2. Duration of the dystocia,
3. Duration of anorexia,
4. Colic pain expression,

5. Eye appearance: conjunctival mucous membranes (normal versus congested) and sclera blood vessels (full versus engorgement),
6. Body temperature: normothermia versus hyperthermia,
7. Heart sound: Tachycardia versus bradycardia, audible versus muffled
8. Ruminal movement: hypermotility versus hypomotility or atony.

In addition, rectal and vaginal examinations were performed to determine the direction (right or left) and degree (mild < 180 °, moderate > 180–270°, high 270° and very high >270°), of uterine torsion.

Blood sampling

Heparinized whole blood samples

Blood samples were collected from jugular vein on lithium heparinized BD vacutainer tubes. Collected samples were used for analysis of blood gases and acid - base balance directly within few minutes from sampling and then subsequently used for complete blood count (CBC) evaluation.

Serum samples

Blood samples were collected in clean, dry centrifuge tubes without anticoagulant. The samples were left for 30 minutes at room temperature until clotting and then centrifuged at 3000 rpm for 20 minutes (Coles and Rich, 1992). The obtained clear non hemolyzed sera were separated and transferred into clean epindorff vials and then stored at -20 °C for determination of serum total protein, glucose and liver enzymes.

Bioassays

Blood gases and acid-base balance

Blood gases and acid-base balance parameters were measured using ABL5 Blood Gas Analyser (Radiometer, Denmark). The machine was calibrated and subjected to test of quality control before assay. The heparinized whole blood samples were thoroughly mixed before analysis.

Complete blood count (CBC) assessment

Total red blood cell count (TRBCs- ×10⁶/mm³), hemoglobin concentration (Hb-g/dl), packed cell volume (PCV%), total and differential leuckocytic counts (TWBSc- and DLC ×10³/mm³), mean corpuscular volume

(MCV-fl), mean corpuscular hemoglobin (MCH-pg), mean corpuscular hemoglobin concentration (MCHC-g/dl), were determined using a fully automated blood cell counter machine, Medonic CA620 Vet hematology analyzer -Sweden.

Biochemical assays

All reagents and kits used in this study were previously tested in our laboratory. Spectrophotometric method by using Phillips Pye Unicam spectrophotometer (U.V. visible Mod. 800) was adopted to determine serum concentrations of the following constituents: glucose (Trinder), total protein (Biuret) and liver enzymes (ALT and AST). All kits and reagents were obtained from Spectrum Reagents (Egyptian Company for Biotechnology, Cairo, Egypt).

Statistical analysis

Data were analyzed using the packaged SPSS program for windows version 10.0.1 (SPSS Inc., Chicago, IL). All data were presented as mean \pm standard error (SE). Differences between groups were determined by LSD Post hoc test. Significance level was set at $P \leq 0.05$.

RESULTS

Clinical findings

All admitted cases of uterine torsion were pluriparous and in the third trimester of gestation period (9.7 ± 0.6 months) with fair body condition score (2.79 ± 0.7 on scale 4). The mean duration of torsion (from appearance of the clinical signs until treatment) was 36.25 ± 23.24 h (range: from 12 to 72 h). Variable degree of colicky pain, constipation and inappetance for variable duration (1-4 days) were observed in all cases. Straining was observed in animals with severe degree of uterine torsion ($\geq 270^\circ$). Reduction in the ruminal movement was recorded in 15 cases (1 cycle per 2 min) while 5 cases expressed no ruminal movement (atonized rumen). Pain expression (grunting), congested mucous membrane and engorgement of sclera blood vessels were noticed in 12 cases. Hydration status was normal in all but 3 cases. In animals that appeared clinically dehydrated, the severity varied from moderate to severe. Three

animals showed evident toxemia, dullness, debility, hyperthermia (39.8 ± 0.3 °C) and tachycardia (107 ± 3 beats/min).

Vaginal examination revealed various degrees (mild, 90° , moderate $120-180^\circ$, severe 270° and very severe $> 270^\circ$) of uterine torsion ($n = 4, 9, 4$ and 3 , respectively). Right-sided uterine torsion was reported in 18 cases while 2 cases showed left-side direction. Vaginal delivery was possible after slow rolling of the mother in 6 of the cases. Cesarean section was performed in 11 cases after failed detorsion attempts ($n = 7$) or due to failure of the cervix to sufficiently dilate following successful correction of the torsion in ($n = 4$) cases. A high amount of peritoneal fluid and cyanosed and fragile uterine wall was reported in one case. Three cases had putrefied uterine discharge, emphysematous fetus and evident toxemia. Detorsion failed in these animals and cesarean section could not be performed. Fetal deaths were recorded in 75 % of cases ($n = 15$).

Blood gases and acid-base balance findings

Venous blood gases and acid base balance data are listed in Table 1. Statistical analysis of these data revealed significant differences compared to control groups. Cases that were not associated with septic uterus ($n = 17$) showed significant rise ($P < 0.05$) in their blood pH value (7.45 ± 0.01) compared to control healthy ones (7.39 ± 0.01). The laboratory indices of metabolic side of blood gases and acid base balance: base excess (BE), bicarbonate (HCO_3) and total carbone dioxide (tCO_2) concentrations, of these cases showed significant increase ($P < 0.05$) while respiratory side of blood gases and acid base balance, pCO_2 , showed changeable value (38 - 53 mmHg) suggesting a case of primary metabolic alkalosis with or without partial compensation. On other hand, only three cases that were associated with putrefaction and emphysematous fetus (septic uterus) showed marked reduction in their blood pH value (7.23 ± 0.02) compared to control healthy ones (7.39 ± 0.01). A significance decrease in the indices of BE, HCO_3 and tCO_2 were reported while no change in the value of

pCO₂ suggesting a case of primary metabolic acidosis with no compensation.

Haematological findings

Mean values of erythrogram and leukogram of the control and affected buffaloes with uterine torsion were presented in Table 2. No statistically significant (P<0.05) change in erythrocyte indices: TRBCs count, Hb concentration and PCV, were recorded compared to control healthy animals while the measured values: MCV, MCH and MCHC, of erythrocyte indices showed significant decrease in both MCV and MCHC. The obtained values for total and differential leukocytic counts showed a significant (P<0.05) increase in total leucocytic count (leucocytosis), granulocytes

and monocytes in uterine torsion compared to control ones.

Biochemical findings

The effects of uterine torsion on some biochemical parameters in buffaloes comparatively to normal buffaloes were illustrated in Table 3. There was a significant (P<0.05) increase in the activities of AST and ALT in uterine torsion compared to control one. The serum total protein showed a significant decrease (5.53 ± 0.19 g/dl) in affected buffaloes while serum glucose level showed inconsistent pattern of change (40-90 mg/dl).

Table 1: Mean ± SE and range of blood gases and acid base balance in healthy and affected buffaloes.

Parameter	Control (n = 6)	Uterine torsion with non septic uterus (n = 17)	Uterine torsion with septic uterus (n = 3)
pH	7.39 ± 0.01 (7.36 - 7.42)	7.45 ± 0.01 ^s (7.40 - 7.51)	7.23 ± 0.02 ^s (7.20 - 7.29)
PCO ₂ (mmHg)	41.80 ± 0.68 (39 - 46)	43.70 ± 1.54 (38 - 53)	42.00 ± 2.51 (37 - 45)
PO ₂ (mmHg)	38.00 ± 0.60 (36 - 42)	51.00 ± 5.35 (26 - 66)	37.00 ± 1.00 (36 - 39)
HCO ₃ (mmol/l)	27.00 ± 0.68 (23 - 30)	30.20 ± 0.94 ^s (27 - 37)	15.66 ± 1.20 ^s (14 - 18)
tCO ₂ (mmol/l)	28.40 ± 0.71 (24 - 32)	31.60 ± 0.97 ^s (28 - 38)	17 ± 1.52 ^s (15 - 20)
BE (mmol/l)	2.30 ± 0.35 (1 - 4)	6.30 ± 0.90 ^s (3 - 13)	-11.00 ± 1.15 ^s (-9 to -13)

^s means significant at p < 0.05 compared to control healthy buffaloes

Table 2: Mean \pm SE and range of complete blood count in healthy and affected buffaloes.

Parameter	Control (n = 6)	Uterine torsion (n = 20)
RBCs ($\times 10^6/\text{mm}^3$)	5.99 \pm 0.08 (5.63 - 6.28)	6.07 \pm 0.24 (4.54 - 7.56)
Hb (g/dl)	13.13 \pm 0.68 (9.30 - 14.90)	12.51 \pm 1.48 (8.60 - 31.10)
PCV (%)	32.28 \pm 0.86 (30.70 - 37.10)	35.45 \pm 1.32 (27.00 - 44.60)
MCV (fl)	53.85 \pm 1.31 (51.20 - 60)	58.69 \pm 1.38 ^s (51.00 - 65.70)
MCH (pg)	21.88 \pm 1.27 (15.60 - 24.10)	17.87 \pm 0.83 (8.80 - 22.10)
MCHC (g/dl)	40.60 \pm 2.17 (30.10 - 44.20)	31.68 \pm 0.43 ^s (28.50 - 33.60)
WBCs ($\times 10^3/\text{mm}^3$)	5.96 \pm 0.15 (5.40 - 6.40)	10.29 \pm 1.06 ^s (5.70 - 16.50)
Lymph ($\times 10^3/\text{mm}^3$)	5.25 \pm 0.11 (5.00 - 5.5)	1.93 \pm 0.29 (0.90 - 3.80)
Gran ($\times 10^3/\text{mm}^3$)	0.08 \pm 0.04 (0.00 - 0.2)	7.71 \pm 0.77 ^s (4.30 - 11.40)
MID ($\times 10^3/\text{mm}^3$)	0.57 \pm 0.06 (0.40 - 0.8)	0.72 \pm 0.09 ^s (0.40 - 1.39)

^s means significant at $p < 0.05$ compared to control healthy buffaloes

Table 3: Mean \pm SE and range of some biochemical indices in healthy and affected buffaloes.

Parameter	Control (n = 6)	Uterine torsion (n = 20)
Serum total protein (g/dl)	6.66 \pm 0.18 (5.9 - 7.2)	5.53 \pm 0.19 ^s (4.50 - 6.90)
Serum glucose (mg/dl)	66.83 \pm 2.31 (59 - 75)	63.23 \pm 0.4.96 (40 - 90)
Serum AST (iu/l)	72.67 \pm 4.29 (59 - 88)	123.16 \pm 14.59 ^s (52.38 - 197.30)
Serum ALT (iu/l)	33.67 \pm 2.12 (28 - 41)	55.51 \pm 5.59 ^s (32.70 - 105.24)

^s means significant at $p < 0.05$ compared to control healthy buffaloes

DISCUSSION

Uterine torsion is a clinically emergency case that needs a prompt medical intervention to overcome rapid potential fatal systemic consequences of dams. It could be simple and readily corrected under field conditions or complicated and needs specialty clinics. Therefore, cases referred to our VTH could be representing the extreme forms (high degree and/or duration) of the condition. Thus, the data presented in this paper are not representative of uterine torsions seen in the

overall bovine population. However, we believe it to be an accurate representation of more serious uterine torsions.

Clinical findings

Stage, direction and degree of uterine torsion

In the present study, most of the presented cases frequently occurred before term with a tendency toward right-sided uterine torsion in buffaloes. These results were in accordance with that of Ali *et al.* (2011). The amount of fetal fluids, in relation to the size, is lower in buffaloes than in cows (Kolla *et al.*, 1999;

Schonfelder and Sobiraj, 2005; Amer *et al.*, 2008) predispose the uterus to sprain from any movement of fetus as pregnancy advances. Additionally, the frequency of the uterus to rotate counter-clockwise was greater in cows than in buffaloes (Roberts, 1986; Amer *et al.*, 2008; Noakes *et al.*, 2009). This might be attributed to the relatively large sized fetus in buffaloes (Anderson and Mogens, 1965) giving no chance for the uterus to slip under the rumen. Variable degrees of torsion were reported in this study, however higher degree ($\geq 270^\circ$) was reported in 35% (7/20) cases and was associated with a history of prolonged duration of straining. The higher percentage of fetal deaths in the present investigation might be attributed to the predominant of a severe degree of uterine torsion and its occurrence before term in buffaloes. This finding is in agreement with earlier report (Ali *et al.*, 2001).

Symptoms

Symptoms of pain such as restlessness, teeth grinding and colic, particularly in complicated cases were noticed. A reduction in food intake, cessation of rumination and ruminal movement were also noted in all admitted cases. Most authors agree that colic and anorexia are common signs in animals with a prolonged or complicated case of uterine torsion (Pearson, 1971; Arthur *et al.*, 1989; Manning *et al.*, 1982; Ruegg, 1989). Although abdominal straining is not reported to be a feature of the condition, it was a common clinical sign in 7 affected buffaloes which could be attributed to the more severe torsions represented in these referral cases.

Tachycardia was a consistent feature, and detection of a markedly elevated heart rate in the clinical examination of preparturient buffaloes should arouse suspicion that a uterine torsion may be present. Our findings agree with previous reports that the heart and respiratory rates tend to be elevated, and that the rectal temperature may be increased in some cases (Anderson, 1958; Arthur, 1966). In our study the mean rectal temperature was within the normal range except 3 cases which had severe degree of uterine torsion for a relatively long time. This is most likely

because often the fetal membranes remained intact even though the placenta had separated. The invasion of putrefactive bacteria is then delayed and thus emphysematous decomposition of the fetus and the onset of toxemia take several days.

Blood gases and acid base balance findings

A consistent finding of metabolic alkalosis with or without partial compensation was reported in 17 cases out of 20. These cases suffered from different degrees of uterine torsion with no evidence of toxemia. This alteration in the blood gases and acid base balance in favor of alkalosis is probably due to anorexia, indigestion and sequestration of large amount of fluid in the uterus (Berkelhammer and Bear, 1984; Kaneko *et al.*, 1997; Radostits *et al.*, 2007). Surprisingly, three cases of uterine torsion showed completely different results of blood gases and acid base balance. These cases had metabolic acidosis with no compensation. Retrospectively to their clinical findings, they showed prolonged straining (4 days), evident toxemia, dehydration and fetid uterine discharge. Acidosis in these cases seems to be multifactorial and could be attributed to endotoxemia and compromised circulation secondary to septic and twisted gravid uterus. Compromised uterine circulation leads to cyanosis of the uterine wall and eventually gangrenes as well as fetal death and may result in putrefaction and gas formation in the fetal subcutis within 24-72 h. Endotoxemia mostly likely developed under these circumstances which leads to peripheral circulatory failure. Reduction in tissue perfusion due to compromised systemic circulation secondary to endotoxemia results in acidosis (Moore *et al.*, 1980; Radostits, 2007). Duration and degree of uterine torsion seem to be decisive factor in the outcome of this condition. Findings of the study suggested that prolonged cases of uterine torsion are life-threatening because of potential development of endotoxemic shock and circulatory dysfunction (Fraser *et al.*, 1996) with subsequent acidemia.

Haematological findings

With regarding to the blood cellular constituents of buffaloes affected with uterine

torsion, there was no significant changes in RBCs, Hb, and PCV, however a significant reduction in the value of MCV and MCHC suggesting a microcytic hypochromic-type of anemia. Clinical pathologist always attributed this type of anemia to iron deficiency. This could be understandable in such cases in the light of long gestation period and decrease feed intake during pregnancy. Decrease in the Hb content (MCHC) was explained by the mother inappetence especially for iron containing rations and temporary iron drained during pregnancy (Younis, 1990). The obtained data for erythrogram come in agreement with El-Shawaf, (1984) and Farrag *et al.* (1984). On other hand, findings of leukogram revealed a significant leukocytosis, granulocytosis, wide granulocyte/lymphocyte ratio and monocytosis compared to healthy control animals. Such obtained results for the leukogram could be considered as a typical response to the stress exerted on the affected animals and due to toxemia resulted from septic uterus containing emphysematous fetus. These results are in agreement with those obtained by Farrag *et al.* (1984); Younis, (1990) and Ibrahim, (1992).

Biochemical findings

In the present study, both serum AST and ALT activity were significantly increased in buffaloes with uterine torsion. The increases in enzymatic activities of liver enzymes are often a reflection of cellular destruction or diseases. Great muscular effort (Farrag, *et al.*, 1984) or damaged uterine cells during parturition result in leakage of such enzymes (Coles and Rich, 1992; Kraft and Dürr, 2005). The increasing level of AST and ALT could also be attributed to the accelerating rate of metabolism and protein biosynthesis needed for fetal growth (Arthur *et al.*, 1989).

Hypoproteiniemia is a consistent finding in this study. The significant reduction in the serum total protein in the affected buffaloes could largely be attributed to the high demand for amino acids in response to fetal growth and colostrums production during late pregnancy (El-Naggar and Abdel-Raouf, 1971; Shehata *et al.*, 1990). Other authors attribute the hypoproteinemia in buffaloes

with reproductive disorders to that the animals often have negative nitrogen balance because of reduced intake of protein (Manal, *et al.*, 1999; Schonfelder and Sobiraj, 2002). Serum glucose level showed inconsistent pattern. Some cases showed evident hypoglycemia and others not. However the overall mean serum glucose level was reported to be 63.23 ± 4.96 compared to 66.83 ± 2.315 mg/dl.

In conclusion, uterine torsion is a serious clinical problem and thorough medical evaluation is needed before and after initiating physical or surgical correction. Clinical evaluation, in particular duration of uterine torsion and evidence of toxemia are critical indices for determination of the outcome. Additionally and importantly, uterine torsion seems to be adversely affected blood gases and acid base balance. Metabolic acidosis in uterine torsion could be an indication of more complicated cases (endotoxemia, septic uterus) and needs an intensive medical attention targeting correction of hemodynamic disturbance associated with such condition. We believe strongly that intensive fluid and anti-endotoxemic therapies must be taken into consideration before and after detorsion.

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