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Relationship between clinical and biochemical picture of uterine torsion in Egyptian Buffaloes (Bubalus Bubalis)

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Abstract

The twisting of the gravid uterus during pregnancy is more common in the Egyptian buffaloes than any other domestic species. Available field and hospital cases (n=36) were included in this study. The treatment procedure and the clinicopathological findings (before detorsion, after detorsion, immediately after birth and 24 hours after birth) of the buffaloes suffering from uterine torsion were investigated. The total number of successfully rolled buffaloes was significantly higher ($P<0.05$) than those failed to be rolled, and the severe torsion needed >2 rolls to be corrected. Caesarean section (C.S) was successfully completed in the majority of cases. The rate of maternal and foetal mortality increased with the severity of torsion. Most cases of torsion were accompanied with dilated cervix than insufficient or closed cervix. The rate of bloody discharge ($P<0.05$) and ruptured foetal sacs increased with the severity of torsion reaching the highest with >270° torsion. Heparinized blood samples were collected to perform a complete blood picture, and plasma samples were used for analysis of some biochemical parameters and hormones. The results of haemogram in the affected buffaloes with uterine torsion showed normocytic normochromic anaemia and leucocytosis accompanied by neutrophilia and monocytosis. Biochemical analysis revealed significant ($P<0.01$) changes in the plasma levels of AST, LDH, glucose, total protein, albumin, blood urea nitrogen (BUN) and creatinine in the affected buffaloes than the control. Hormonal analysis showed significant ($P<0.001$) increase in progesterone and cortisol levels in association with a significant ($P<0.001$) decrease in the level of estradiol-17ß in the affected buffaloes with uterine torsion. The present study suggested that, there was a significant change regarding the haemogram, biochemical constituents and hormonal profiles, specially before and after detorsion and immediately after birth in Egyptian buffaloes with uterine torsion.

INTRODUCTION

Torsion of the gravid uterus in bovine is a common condition encountered by the field veterinarians and has been reported to be one of the major causes of dystocia (Pearson, 1975; Sidiquee and Mehta, 1992; Singh et al., 1992). It is observed more commonly in multiparous and advanced pregnant animals (Roberts, 1986). The uterine torsion leads to narrowing of the birth canal causing dystocia and representing about 5-30% of the dystocial cases. However, the incidence of uterine torsion represented about 29.5% to 30.6% of the buffaloes with dystocia (Sidiquee and Mehta, 1992). The torsion observed mostly during spring when cattle are let onto pasture after prolonged stabling (Roberts, 1986).

Essentially the condition can result from either a predisposing or a direct cause. During pregnancy, there is a relatively small increase in the length of the broad ligaments causing the uterus to curve around the point of attachment, coming to lie between the rumen, intestines and abdominal wall (Manning et al., 1982 and Roberts, 1986). This anatomical arrangement permits an increased uterine mobility in late gestation and predispose to development of a uterine torsion (Roberts, 1986; Sloss and Dufty, 1980). Even in the last months of pregnancy, when horn asymmetry becomes maximal, uterine torsion is an exception rather than the rule. The direct cause is the majority an active one, and any condition which permits increased mobility of the uterus may predispose to uterine torsion (Roberts, 1986).

High concentrations of various biochemical constituents like enzymes (LDH and AST), glucose, blood urea nitrogen, creatinine and cortisol have been reported in pregnant cows and buffaloes affected by various degrees of uterine torsion (Frazer, 1988; Nigel et al., 1992; Ghuman et al., 1997). Few studies were carried out on the effect of uterine torsion on peripheral plasma hormones especially progesterone and estradiol-17 in buffaloes (Bugalia et al., 1995; Sosa and Agag, 1997).

The present work was conducted to find a relationship between the treatment of uterine torsion and some haematological, biochemical and hormonal alterations in Egyptian buffaloes.

MATERIAL AND METHODS

ANIMALS

A total number of 36 clinical cases of Egyptian buffaloes suffering from uterine torsion were included in this study during a period of two spring seasons. Sixteen animals were considered as individual cases in the field, and twenty animals were presented for treatment in the clinic of Obstetrics and Gynaecology, Faculty of Veterinary Medicine, Zagazig University. Some of these cases were primiparous but others were pluriparous and operated either at the end of gestation period when they exhibited signs of labour and straining or, few days/weeks towards the end of gestation when the symptoms appeared without parturition. In delayed cases mild colicy pain, partial anorexia, dullness, depression, debility and shrunken udder were observed.

TREATMENT PROCEDURES

All the cases were put under two types of treatment, either non-surgical (rolling) or surgical by laparohysterotomy (Caesarean Section). The type of handling depended mainly on the severity of torsion as well as the health condition of affected animals.

ROLLING

Trials of detorsion were done sporadically in 36 cases of uterine torsion by rolling in the laying position in the direction of torsion. This method is indicated if the buffalo is recumbent and the fetus can not be reached due to the location or severity of the torsion, or if the animal is pre-parturient (Sloss and Dufty, 1980; Roberts, 1986). The severity of the torsion and the stage of cervical dilatation were critically.

CAESAREAN SECTION

C.S was required in 13 cases in which attempts for correction by rolling were unsuccessful. The operation was usually carried out with animal laying (lateral recumbency), and using the local infilteration at the site of incision with procaine hydrochloride 3% (Roberts, 1986; Frazer et al., 1996). An incision was made in the layers of the abdominal wall, then in the gravid horn with a scalpel. The foetus and the foetal membranes were removed. After local application of tetracyclins in the uterine horn, it was sutured with No. 4 chromic catgut and detorsed. All the incised layers were sutured layer by layer by No. 4 chromic catgut, but the skin sutured by No. 5 braided nylon. Tetracyclines and oxytocine were intramuscularly injected and fluid therapy was intravenously administered (Roberts, 1986).

CLINICOPATHOLOGICAL INVESTIGATIONS

Blood samples were collected from 32 buffaloes suffering from uterine torsion (9 animals before detorsion, 8 animals after detorsion, 8 animals immediately after birth and 7 animals 24 hours after birth)via jugular venipuncture in heparinized tubes. Also blood samples were collected from 6 normal pregnant animals near term and used as a control group.

HAEMATOLOGICAL PROFILE

Erythrocytic count (RBCs), haemoglobin concentration (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), total and differential leukocytic counts, included total leucocytic count (TLC), neutrophils (N), lymphocytes (L), monocytes (M) and eosinophils (E) were determined by standard techniques according to Jain (2000).

BIOCHEMICAL PROFILE

Plasma was separated by centrifugation of heparinized blood in clean and dry centrifuge tubes at 3000 rpm for 20 minutes and kept at – 20° until running the biochemical analysis. The plasma levels of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) (Reitman and Frankel, 1957), lactate dehydrogenase (LDH) (Wootton, 1982), total protein (TP) (Peters, 1968), albumin (Doumas et al., 1971), glucose (Tietz, 1986), blood urea nitrogen (BUN) (Patton and Crouch, 1977) and creatinine (Seeling and Wust, 1969) were determined using colorimetric methods.

HORMONAL PROFILE

Plasma progesterone, estradiol-17 and cortisol were assayed by radioimmunoassay (Abraham, 1981) using kits from Diagnostic Products Corporation (Los Angles, USA). Assay had sensitivities of 0.02 ng/ml, 8.0 pg/ml and 0.025 pg/dl with intra-assays coefficient of variations of 4.65, 5.30 and 4.70%, respectively.

Statistical analysis: The obtained data were statistically analysed according to Statistical Analysis System (SAS, 1987). Analysis included mean values, standard error, and analysis of variance (ANOVA) using F-test. Comparison between groups was done by Chi-squar (2) and the least significant difference (LSD).

RESULTS

The method of correction of uterine torsion depended upon the stage of gestation, the severity of torsion and the condition of uterus and foetus. Successful rolling of the buffaloes around the longitudinal axis and vaginal delivery was significantly higher (P<0.05) in the cases suffering from uterine torsion with <90° and 90°-180° than with 180°-270° and >270°. With increasing the severity of torsion, the successful trials to roll the buffalo and deliver a fetus were decreased. Totally, the number of buffaloes that were successfully rolled and got rid of foeti was significantly higher (P<0.05) than the animals when failed to be rolled. Additionally, the number of rolls, needed to correct the condition, increased significantly (P<0.05) with increasing the severity of the torsion (table 1).

The C.S was performed following the detorsion failure, as it was necessary because of incomplete cervical dilatation after successful correction of the torsion. The operation was successfully completed in the majority cases. With light degree of torsion, higher rate of successful C.S was obtained compared to the cases suffering from severe degree of torsion.

After detorsion and C.S, the rates of maternal and foetal mortality were recorded and listed in table 2. The total mortality rate in the maternal side was 30.6% and of the delivered foeti was 55.6%. There was an increase in the rate of maternal and foetal mortality with increasing the severity of torsion reaching the maximum with >270°.

Immediately after the detorsion and C.S, the majority of cases was recorded in association with the first stage of labour with dilated cervix (table 3). With the severe torsion, the rate of dilated cervix was increased reaching the highest with >270 and the lowest with <90°. However, low rate of bloody uterine discharge was found with <90° that increased significantly (P<0.05) with the severity of torsion reaching the maximum with >270°.

Collectively, approximate equal rates of intact and ruptured foetal sacs were observed after the detorsion and C.S. The lowest rate of ruptured foetal sacs was observed with <90° that increased with the severity of torsion reaching the highest with >270°.

Figure 1

Table 1: Treatment trials used for the correction of uterine position in the buffaloes suffering from uterine torsion with different severity

Degree of Torsion	No.	Rolling n (%)				Caesarean section n (%)		
		Successful			Unsuccess.		Successfull	Unsuccessfull
		1-2rolls	>2rolls	Total				
<90°	6	6(100)	0(0.0)	6(100)	0(0.0)	0	0(0.0)	0(0.0)
90 – 180°	6	4(66.7)	1(16.7)	5(83.3)	1(16.7)	1	1(100)	0(0.0)
180 - 270°	16	4(25.0)	6(37.5)	10(62.5)	6(37.5)	6	4(66.6)	2(33.3)
>270°	8	0(0.0)	3(30.8)	3(30.8)	5(62.5)	5	2(40.0)	3(60.0)
Total	36	14(38.9)	10(27.8)	24(66.7)	12(33.3)	12	7(58.3)	5(41.7)

χ^2 of rolling was calculated=14.250 with probability 0.027- significant at level P<0.05); χ^2 of C.section was calculated=4.683 with probability 0.861- non-significant, Success. and Unsuccess. (Successful and Unsuccessful correction)

Figure 2

Table 2: The rate of maternal and foetal mortality after the correction of uterine torsion with different methods.

Degree of torsion	No. of cases	Rate of total mortalitiy n=36 (%)	
		Maternal mortality	Fetal mortality
<90°	6	0 (0.0)	1 (16.7)
90 - 180°	6	1 (16.7)	2 (33.3)
180 - 270°	16	5 (31.3)	11 (68.8)
>270°	8	5 (62.5)	6 (75.0)
Total	36	11 (30.6)	20 (55.6)

χ^2 of mortality was calculated =1.159 with probability of 0,763 - non-significant

Figure 3

Table 3: The cervical and uterine findings following the correction of uterine torsion in Egyptian buffaloes.

Parameter		Degree of uterine torsion n(%)				
		<90° n=6	90-180° n=6	180-270° n=16	>270° n=8	Total n=36
Cervical dilatation:	dilated	1(16.7)	3(50.0)	9(56.2)	6(75.0)	19(52.8)
	insufficient	2(33.3)	1(16.7)	3(18.8)	1(12.5)	7(19.4)
	closed	3(50.0)	2(33.3)	4(25.0)	1(12.5)	10(27.8)
Uterine discharge:	bloody	1(16.7)	2(33.3)	6(37.5)	7(87.5)	16(44.4)
	normal	5(83.3)	4(66.6)	10(62.5)	1(12.5)	20(55.6)
Foetal membranes:	intact	5(83.3)	3(50.0)	9(56.3)	2(25.0)	19(52.8)
	ruptured	1(16.7)	3(50.0)	7(43.7)	6(75.0)	17(47.2)

χ^2 of cervical dilatation was calculated=4.948 with probability 0.055 (non-significant); χ^2 of uterine discharge was calculated=8.494 with probability 0.037 (significant, P<0.05); χ^2 of fetal mem. state was calculated=4.820 with probability 0.185 (non-significant).

HAEMATOLOGICAL FINDINGS

Mean values of erythrogram and leukogram of the affected buffaloes with uterine torsion (before detorsion, after detorsion, immediately after birth and 24 hrs after birth) compared to normal buffaloes were recorded in table 4. A significant (P<0.05) decrease in RBCs count (before detorsion and after detorsion), Hb concentration and PCV, with no statistically significant change in blood indices, indicated the presence of normocytic normochromic anaemia (before detorsion, after detorsion and immediately after birth) were encountered in the affected buffaloes in comparison with the control. The obtained values for total and differential leukocytic counts in buffaloes with uterine torsion showed a significant (P<0.05) increase in total leucocytic count (before detorsion and immediately after birth), neutrophils, neutrophil/lymphocyte ratio, and monocytes (before detorsion, after detorsion and immediately after birth). A significant decrease (P<0.05) in eosinophils (before detorsion, after detorsion and immediately after birth), in association with insignificant change in lymphocytic count in the affected buffaloes were recorded when compared with the normal buffaloes.

Figure 4

Table 4: Haemogram of the buffaloes suffering from uterine torsion (Means S.E.)

Parameters	Control n=6	Before detorsion n=9	After detorsion n=8	Immediately after birth n=8	24 hrs after birth n=7
Erythrogram					
RBCs (10^6/ul)	8.09±0.32 ^{a}	6.78±0.15 ^{c}	7.30±0.16 ^{bc}	7.85±0.03 ^{ba}	7.92±0.06 ^{a}
LSD=0.557					
Hb (gm/dl)	12.09±0.51 ^{a}	9.58±0.55 ^{c}	10.13±1.57 ^{b}	10.46±0.29 ^{b}	11.95±0.04 ^{a}
LSD=1.490					
PCV (%)	36.25±0.49 ^{a}	31.37±0.60 ^{c}	31.30±0.65 ^{c}	34.17±0.17 ^{b}	35.37±0.73 ^{ba}
LSD=1.781					
MCV (fl)	44.96±1.67 ^{a}	42.25±0.95 ^{a}	42.47±1.43 ^{a}	43.94±0.32 ^{a}	44.66±0.58 ^{a}
LSD=3.498					
MCH (pg)	14.62±1.02 ^{ba}	14.54±1.05 ^{ba}	16.37±0.53 ^{a}	14.60±0.36 ^{ba}	15.10±0.16 ^{a}
LSD=2.264					
MCHC (%)	34.29±1.34 ^{a}	30.99±1.29^{cba}	32.11±4.40 ^{ba}	33.53±1.00 ^{ba}	33.81±0.78 ^{ba}
LSD=6.965					
Leukogram					
TLC(x10^3/ul)	9.27±0.29 ^{c}	13.10±0.44 ^{a}	10.41±0.31 ^{cb}	10.99±0.58 ^{b}	9.39±0.33 ^{c}
LSD=1.279					
N. (x10^3/ul)	3.86±0.14 ^{c}	5.82±0.07 ^{a}	4.85±0.05 ^{b}	5.60±0.31 ^{a}	4.03±0.02 ^{c}
LSD=0.493					
L. (x10^3/ul)	4.64±0.30 ^{a}	3.67±0.33 ^{a}	4.03±0.02 ^{a}	3.92±0.52 ^{a}	4.64±0.18 ^{a}
LSD=1.008					
N/L	0.83±0.02 ^{c}	1.62±0.18 ^{a}	1.20±0.02 ^{b}	1.71±0.03 ^{a}	0.87±0.03 ^{c}
LSD=0.262					
M. (x10^3/ul)	0.38±0.07 ^{c}	3.38±0.45 ^{a}	1.33±0.20 ^{b}	1.33±0.44 ^{b}	0.44±0.07 ^{cb}
LSD=0.939					
E. (x10^3/ul)	0.46±0.07 ^{a}	0.19±0.02 ^{b}	0.18±0.08 ^{b}	0.19±0.10 ^{b}	0.36±0.11 ^{ca}
LSD=0.263					

LSD=least significant difference

Mean values within the same row with different superscripts are significantly different (P<0.05).

BIOCHEMICAL FINDINGS

The effects of uterine torsion (before detorsion, after detorsion, immediately after birth and 24 hours after birth) on some biochemical parameters in buffaloes comparatively with normal buffaloes were illustrated in table 5. There was a significant (P<0.01) increase in the activities of AST in all affected buffaloes with uterine torsion and LDH (before and after detorsion, and immediately after birth) as well as plasma levels of glucose (before and after detorsion, immediately after birth and 24 hours after birth), BUN (before and after detorsion, and immediately after birth) and creatinine (before and after detorsion).

The plasma total protein and albumin showed a significant (P<0.01) decrease in all the affected buffaloes with uterine torsion, while globulins were insignificantly changed, when compared with the control except at 24 hours after birth; they showed a significant decrease.

HORMONAL ANALYSIS

In the present study, the mean value of plasma progesterone was significantly (P<0.001) increased in buffaloes before and after detorsion and immediately after birth (1.36 0.13, 1.29 0.08 and 1.00 0.01 ng/ml) respectively in comparison with the normal buffaloes (0.45 0.01 ng/ml), while it showed insignificant change at 24 hours after birth (0.48 0.02 ng/ml) as illustrated in figure 1. Highly significant (P<0.001) decrease in the levels of estradiol-17 was recorded only before and after detorsion, and immediately after birth (59.50 1.30, 63.36 1.20 and 78.80 2.00 pg/ml) respectively in comparison to the control animals (106.63 1.70 pg/ml) with no change at 24 hours after birth (105.43 2.16 pg/ml). There was highly significant increase (P<0.001) in plasma level of cortisol in the affected buffaloes before and after detorsion as well as immediately after birth (12.96 0.05, 12.92 0.01 and 8.52 0.06 pg/ml) respectively, but it showed no significant statistical change in the buffaloes 24 hours after birth (1.90 0.05 pg/ml) in comparison to the control animals (1.88 0.03 pg/ml).

Figure 5

Table 5: Biochemical parameters in the plasma of the buffaloes suffering from uterine torsion (Means S.E.)

Parameters	Control n=6	Before detorsion n=9	After detorsion n=8	Immediately after birth n=8	24 hrs after birth n=7
AST (iu/l)	61.35±3.37 ^{b}	94.70±1.09 ^{a}	93.07±2.61 ^{a}	92.50±3.27 ^{a}	88.68±0.43 ^{a}
LSD=7.751					
ALT (iu/l)	32.83±0.89 ^{a}	44.11±3.01 ^{a}	42.18±6.66 ^{a}	37.62±2.84 ^{a}	33.68±2.96 ^{a}
LSD=11.878					
LDH (iu/l)	296.67±0.88 ^{c}	314.55±1.17^{a}	308.99±6.61^{ba}	309.28±4.40^{ba}	298.36±1.00^{bc}
LSD=11.461					
TP (gm/dl)	8.33±0.27 ^{a}	7.45±0.11 ^{bc}	7.04±0.02 ^{c}	6.85±0.16 ^{c}	6.18±0.41 ^{c}
LSD=0.739					
Alb. (gm/dl)	4.50±0.18 ^{a}	3.65±0.09 ^{bc}	3.62±0.02 ^{bc}	3.40±0.31 ^{c}	3.08±0.28 ^{c}
LSD=0.645					
Glob. (gm/dl)	3.83±0.36 ^{a}	3.80±0.29 ^{a}	3.48±0.34 ^{a}	3.45±0.36 ^{a}	3.00±0.14 ^{b}
LSD=0.374					
Gluc. (mg/dl)	63.00±1.53 ^{c}	94.33±2.96 ^{a}	96.59±4.01 ^{a}	88.44±2.06 ^{a}	76.04±2.28 ^{b}
LSD=8.525					
BUN (mg/dl)	15.39±0.85 ^{b}	18.96±0.79 ^{a}	19.35±0.32 ^{a}	19.15±2.15 ^{a}	16.68±0.33 ^{ba}
LSD=3.509					
Creat. (mg/dl)	0.95±0.03 ^{c}	2.16±0.12 ^{a}	1.91±0.04 ^{b}	0.90±0.05 ^{c}	0.95±0.03 ^{c}
LSD=0.199					

LSD=least significant difference

Mean values within the same row with different superscripts are significantly different (P<0.01).

Figure 6

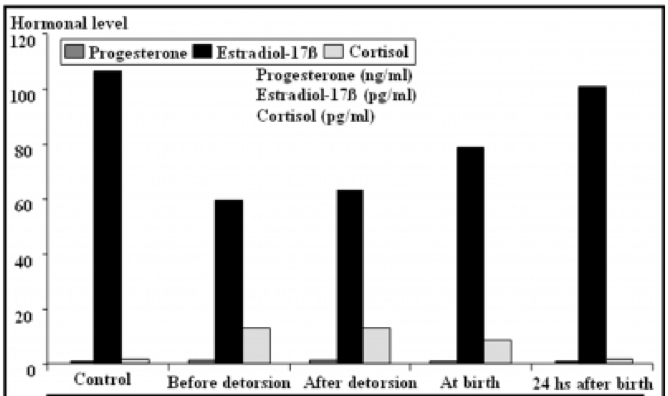

Fig. 1: Plasma hormonal levels of the buffaloes suffering from uterine torsion (significant at level P<0.001)

DISCUSSION

Uterine torsion is a common condition causing dystocia in bovine. Its simple form (90°-180°) is readily corrected under field conditions, but some cases referred to speciality clinics tend to represent the more extreme forms of the condition (Arthur et al., 1989). Thus, we believe in the presented study to be accurate and represent simple as well as more serious uterine torsions >180°.

In the present study, the successful rolling of the buffaloes around the longitudinal axis and vaginal delivery was significantly higher in the cases with <90° and 90°-180° than 180°-270° and >270°. With increasing the severity of the torsion, the successful trials to roll the buffalo and deliver a foetus were decreased, and more number of rolls were needed. The total number of buffaloes that could be successfully rolled and got ride of foeti was significantly higher. The C.S was performed following the unsuccessful attempts for correction or detorsion, as it was necessary because of incomplete cervical dilatation after the unsuccessful correction of the torsion. With light degree of torsion, higher rate of successful C.S was obtained compared to the cases suffering from severe torsion. However, there are several methods availabe to untwist a bovine uterus and there is no standard method which is applicable to every torsion (Manning et al., 1982; Roberts, 1986; Cergoli et al., 2002). The alternate nonsurgical approach (rolling) is indicated if the cow is recumbent, the foetus can not be reached due to the location or severity of the torsion (Sloss and Dufty, 1980; Arthur et al., 1989; Hazzaa et al., 1987). Thus, rolling may be successful in correcting the torsion in 84% of cases, but if the torsion has not been relieved after 3 to 5 attempts then surgery is indicated (Sloss and Dufty, 1980; Roberts, 1986). In a previous study, in spite of repeated rolling; the torsion persisted and C.S had to be performed (Cergoli et al., 1999; Murty et al., 1999; Bellows and Lammoglia 2000). In agreement with the late authors, the surgery was performed immediately in the cases, after failure of detorsion attempts and due to failure of the cervix to dilate following successful correction of the torsion. The failure to roll twisted uterus could be attributed to adhesions (Luthra and Khar 1999), however; after detachment of adhesions, full detorsion was not possible in these 4 cases (Sharma et al. 1995). After the torsion is corrected; several hours should be allowed for full dilatation of the cervix to occur. However, failure to untwist the uterus or inadequate cervical dilatation after correction may necessitate a C.S. A dam with a friable, septic uterus containing an emphysematous foetus is a poor candidate for either detorsion or abdominal surgery.

The total mortality in the maternal side was 30.6% and of the delivered foeti were 55.6%. There was an increase in the rate of maternal and foetal mortality with increasing the severity of torsion. Immediately after the detorsion and C.S, the majority of cases was at the first stage of labor and dilated cervix. The rates of bloody uterine discharge and rupture of foetal sacs were low with <90° and increased significantly with the severity of torsion. In some studies, maternal recovery rates should remain high unless severe toxemia or necrosis of the uterus has developed (Roberts, 1986; Arthur et al., 1989). In cows, mortality rates ranged from 5 to 18% depending on whether the study was based on field or hospital cases (Sloss and Dufty, 1980; Roberts, 1986). In this study, 30.6% of the buffaloes were euthanized due to the compromised state of the uterus, and the survival rate for the remaining buffaloes was 69.4%. These animals appeared to die from endotoxic shock, and we believe that this is a potential complication once a severe torsion is corrected and perfusion returnes.

The diagnosis and correction of uterine torsion provide a favorable prognosis for both foetus and cow (Roberts, 1986; Arthur et al., 1989). The viability of the calf depends on the method of correction and the failure of the cervix to be fully dilated, as high mortaility was recored with completely closed cervix. However, delay in diagnosis results in the delivery of a dead foetus since hypoxia can result from placental separation even in the presence of unruptured membranes (Sloss and Dufty, 1980; Arthur et al., 1989). The high rate of foetal mortality (55.6%) in the present study, was due to the bad condition of most cases and development of some complications leading to death of more foeti. It has been suggested that, the severity of the twist does not directly affect the survival of the foetus, but in our opinion the amount of uterine vascularity is definitely a factor. Another study showed no evidence of ischemia or gangrene of the myometrium (Pearson, 1975), whereas we have observed frequently a cyanotic uterus, especially in the more severe torsions which failed to be corrected prior to surgery. The condition of the foetus appears to be more influnced by the duration of the condition rather than the severity of the torsion, subsequently; some authors obtained between 44 to 58% fetal survival rates during the early uterine torsion (Sloss and Dufty, 1980; Manning et al., 1982). The viability or survival rate is difficult to be explained, but obviously some factors such as duration of the condition and severity of the torsion are major determinants of the outcome. However, once the torsion has been corrected, the degree of cervical dilation determines whether foetal extraction can proceed (Sloss and Dufty, 1980).

The cervix seldom dilates if the foetus is already dead, and often this is the case even if the foetus is alive. A delay of only 2 to 3 hours may result in the death of the foetus (Pearson, 1975). However, the severity and duration of the torsion appear to play a major role in the probability of further dilation. In a British study, 98% of cases was at term and had variable amounts of cervical dilation present when examined at hospital. On the other side, an indurated cervix is unlikely to dilate and manual stretching of a partially dilated cervix is seldom successful (Pearson, 1975; Sloss and Dufty, 1980). Moreover, the uterine and cervical tissues in the vicinity of the torsion may be extremely friable and subject to rupture when traction is applied to the foetus (Roberts, 1986). We are convinced that above average foetal size plays a major role in the etiology of this condition, the cervical sectioning did not consider to be a viable option.

It is unusual for the foetal membranes to be ruptured in the light as well as the more cases where the torsion is at least 180°. In these cases if the foetus is still alive and the cervix does not appear to be completely dilated, it may be preferable to attempt detorsion without rupturing the foetal membranes (i.e., roll cow). Once the foetal fluids have been released the duration of foetal viability is markedly reduced (Pearson, 1975; Arthur et al., 1989), even in cases with intact membranes there may be already some placental separation and foetal hypoxia (Arthur et al., 1989). If the foetus is believed to be dead, release of the foetal fluids will reduce the weight of the uterus and facilitate manual detorsion (Roberts, 1986). On the growth examination of the gravid horn, which contained only one foetus, showed placental separation and severe haemorrhage due to venous congestion (Brown, 1974), but the uterus with twin pregnancy predicated the rotation of the uterus and separation of the placenta with clotted blood in the ovarian extremity.

With regarding to the blood cellular constituents of buffaloes affected with uterine torsion, there was normocytic normochromic anaemia which is a result of accumulation of metabolic waste products or deficiency of the raw materials during pregnancy which are needed for cell production leading to inhibition of erythropoeisis (Coles, 1986). This type of anemia was manifested by a significant decrease in the RBCs count, Hb content and PCV%, which may be attributed to the increased plasma volume during pregnancy (Barakat, 1982) or due to the relatively large loss of blood during labour. Moreover, estradiol-17β hormone plays an important role in the erythrocytic picture,which leads to hydraemia in the circulation (El-Baghdady, 1979), since estrogen possesses an inhibitory effect on the erythropoeisis (Siegol, 1970; Duncan et al., 1994). The decrease in the Hb content was explained by the mother inappetite especially for iron containing rations, in which iron was temporary drained during pregnancy (Younis, 1990). The obtained data for erythrogram come in agreement with El-Shawaf (1984) and Farrag et al. (1984).

Dealing with leukocytic changes in buffaloes before and after detorsion, immediately after birth and 24 hours after birth, our findings revealed a significant leukocytosis, neutrophilia, wide N/L ratio and monocytosis in association with eosinopenia when compared with the normal control animals. Such obtained results for the leukogram could be considered as a typical response to the stress exerted on the affected animals at those mentioned stages. Another possibility for these data is related to the increased levels of cortisol in this study or due to toxemia resulted from septic uterus containing emphysematous foetus in some cases. These results are in agreement with those obtained by Farrag et al. (1984); Younis (1990) and Ibrahim (1992). Moreover, leukocytosis and neutophilia were recorded in the affected mare with uterine torsion (Nigel et al., 1992), as well as in sows at parturition (Osterlundh et al., 1998).

Regarding the enzymatic activity, transaminases (AST and ALT) are present in small quantities in serum of ruminants as a consequence of normal tissue destruction and subsequent enzyme release (Coles, 1986). Moreover, the increases observed are often a reflection of cellular destruction or diseases. In the present study, the plasma AST activity was significantly increased in buffaloes with uterine torsion. This is in coincidence with the results of El-Din Zain et al. (1995); Oliveira et al. (1998) and Hoeben et al. (2000). The increase of AST was necessary for accelerating the rate of metabolism and protein biosynthesis needed for foetal growth as well as milk production (Arthur, 1989). In addition, the increase in AST levels may be due to great muscular effort which is exerted during the process of calving (Farrag et al., 1984) or may be related to the hormonal changes that occured during the last stages of gestation. At the same time, it could be concluded that the nutritives differences such as inbalance in proteins and carbohydrates or insufficient crude fiber content resulted in upsetting the proper function of the rumen, causing more or less harmefull energetic deficiency and damage of liver leading to increase of AST activity (Younis, 1990). On contrary, ALT determination showed non significant change in this work. Such result was supported by a previous finding (El-Shawaf, 1984). In the same time, the measurement of ALT activity in cattle is of little use in diagnosis of liver disease, however; AST is of some use but is not liver specific as LDH (Medway et al., 1974).

Lactate dehydrogenase (LDH) is an intracellular enzyme, widely distributed in animal tissues and released following cellular damage (Coles, 1986). The present results indicate that LDH activity was significantly increased in buffaloes with uterine torsion specially before and after detorsion as well as immediatly after birth. This finding was in agreement with those recorded by Mohamed and Noakes (1985) and Hoeben et al. (2000). Moreover, the increased levels of enzymatic activities (AST and LDH) may be attributed to leakage of such substances from necrotic or damaged uterine cells (El-Din Zain, 1997). Also, it was believed that the increase in these enzymes is related to high levels of progesterone during this period of pregnancy (Shehata et al., 1990) or referred to the release of enzymes from the uterine muscles near the term (Mohamed and Noakes, 1985). On the other hand, non-significant change in LDH activity in cattle with dystocia was recorded in a previous study (Atallah et al., 1999).

The data obtained for proteinogram showed significant decrease in total proteins and albumin in the affected buffaloes in comparison to the control. Such reduction in the concentration of maternal plasma proteins at late pregnancy in the Egyptian buffaloes co-incided with the rapid increase in the uterine weight and its contents mainly the fetus, fetal fluids and fetal membranes (El-Naggar and Abdel-Raouf, 1971; Shehata et al., 1990). Whereas, the decrease in total proteins or albumin as the animals approach birth may be the cause of physiological oedema occuring at this time or as a result of bloody fluid loss at birth (Kanekeo et al., 1997) and their decrease postpartum was due to transfer of proteins into the colostrum. Moreover, hypoalbuminemia was probably associated with liver malfunction immediately after calving (Rowlands et al., 1980). Similar results were obtained in mare (Nigel et al., 1992), and in buffaloes (Patel et al., 1999; El-Din et al., 2000). Meanwhile, hypoproteinemia in buffaloes with reproductive disorders could be attributed to that the animals often have negative nitrogen balance because of reduced intake of protein (Manal et al., 1999; Schoenfelder and Sobiraj, 2002). Hypoglobulinemia recorded in the affected buffaloes especially after birth by 24 hours may be due to transfer of immunoglobulins into colostrum for protection of foetus (Duncan et al., 1994).

Hyperglycemia observed in the affected buffaloes as compared to the normal one, may be attributed to that the animals with torsion become under anoxic condition which increases liver glycogenolysis (Coles, 1986) or may be due to stress condition and increased secretion of ACTH (Kanekeo et al., 1997). Moreover, the increased level of glucose in this study may be related to the increased level of cortisol which increase gluconeogenesis (Payne, 1987). Also, Ghuman et al. (1997) interpreted the increased adrenocortical activity and plasma glucose concentration in pregnant buffaloes affected by 180° to 360° uterine torsion to stress response. Our results are in accordance with Nigel et al. (1992) and Bellows and Lammoglia (2000).

The increased levels of urea and creatinine in this study could be related to stress condition exerted on the affected buffaloes with concomitantly reduced blood flow to kidneys and reproductive tract or may be due to loss of relatively large amounts of blood during calving. At the same time, our results may be attributed to nephropathy resulted from toxic substances liberated from dead fetuses in some cases of uterine torsion (Arthur et al., 1989). Another possibility is moderate dehydration as a result of observed diarrhea in some cases. These results may be attributed to increased energy mobilization during the precalving period (Kudlac et al., 1995). The present results are in coincidence with those reported in previous studies (Nigel et al., 1992; Manal et al., 1999). In addition, it had been recorded that an elevation of BUN and creatinine may be due to concomitant breakdown of tissues during gluconeogenesis under effect of increased cortisol level (Payne, 1987).

One of the main goals of the present study was to identify a blood markers that could be used to predict the risk of uterine torsion in the mother and fetus. Hormonal analysis indicated that there were disturbances in the plasma levels of progesterone, estradiol-17β and cortisol in all samples either before or after detorsion and immediatly after birth and they returned to the normal levels after birth by 24 hours.

Highly significant increase and decrease in plasma progesterone and estradiol-17β were recorded respectively in affected buffaloes when compared to the control. These results are in agreement with those obtained by Bugalia et al. (1995); Sosa and Agag (1997); Abdel-Ghaffar and Abou-El-Roos (2002) in buffaloes affected with uterine torsion as well as Atallah et al. (1999) and Zhang et al. (1999) in cattle with dystocia. Also ,our observations are in line with O´Brien and Stott (1976) who reported higher and lower concentrations of progesterone and estradiol-17β respectively in dystocial cows. Such hormonal profile associated with uterine torsion in the buffaloes, could be attributed to the alive foetus which might delay the onset of luteolysis and maintain high progesterone output and thereby low levels of estrogen for maintenance of pregnancy because the foetus release prostaglandins (PGE2) which have luteotropic effects (Hafez, 2000).

Concerning the plasma cortisol level, significant increase was observed in all the affected buffaloes with uterine torsion. This finding is a picture of stress condition found in the affected animals. Since pregnancy, torsion and/or parturition are reported as the main physiological events in the female (Stott, 1981), the maternal adrenal gland is activated during the last days of pregnancy and is further stimulated during torsion or parturition to give high cortisol levels to mother during and after birth. Our results coincide with previous reports (Sosa, 1994; Bellows and Lammoglia, 2000). Similarly, Ghuman et al. (1997) attributed the increased level of cortisol to stress condition in buffaloes affected by 180° to 360° uterine torsion.

The present study indicated that, with a few notable exceptions, veterinary attention is directed quickly to the parturient animals where the uterine torsion is altimately of foetal and maternal origin inducing clinicopathological alterations in the blood of affected buffaloes. Subsequently, the antepartum nutritional disorders and stress factors could be avoided for lowering the occurrence of uterine torsion in the Egyptian buffaloes.

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