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Uterine Twisting During Pregnancy in Buffaloes: Relatioship Between Clinical Findings and Biochemical Indices

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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.

Key words: Twisting, Uterus, Buffaloes, Foetal, Progesterone, Cortisol.

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 [44,54,56]. 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 [54]. The torsion observed mostly during spring when cattle are let onto pasture after prolonged stabling [47].

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 [33,47]. This anatomical arrangement permits an increased uterine mobility in late gestation and predispose to development of a uterine torsion [47,57]. 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 permits increased mobility of the uterus may predispose to uterine torsion [47].

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 (21,23,37]. Few studies were carried out on the effect of uterine torsion on peripheral plasma hormones especially progesterone and estradiol-17ß in buffaloes [8,59].

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 procedure

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 [47,57]. 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 infiltration at the site of incision with procaine hydrochloride 3% [22,47]. 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 [47].

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.

1- 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 [28].

2- 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) [46], lactate dehydrogenase (LDH) [62], total protein (TP) [45], albumin [12], glucose [61], blood urea nitrogen (BUN) [42] and creatinine [50] were determined using colorimetric methods.

3- Hormonal profile

Plasma progesterone, estradiol-17ß and cortisol were assayed by radioimmunoassay [2] 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 [49]. Analysis included mean values, standard error, and analysis of variance (ANOVA) using F-test. Comparison between groups was done by Chi-square (χ^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.

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 (%)**				**Caeserean section n (%)**		
		Successfull			**Unsuccess.**	**No.**	**Successfull**	**Unsuccess.**
		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)

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°.

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; Unsuccess. =Unsuccessfull

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.

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

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.

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

Parameter		Degree of uterine torsion n(%)				
		<90°	**90-180°**	**180-270°**	**>270°**	**Total**
		n=6	**n=6**	**n=16**	**n=8**	**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).

compared with the control except at 24 hours after birth; they showed a signif cant decrease.

Hormonal analysis

The mean value of plasma progesterone was signi f cantly

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 signif cant difference

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

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 signif cant difference

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

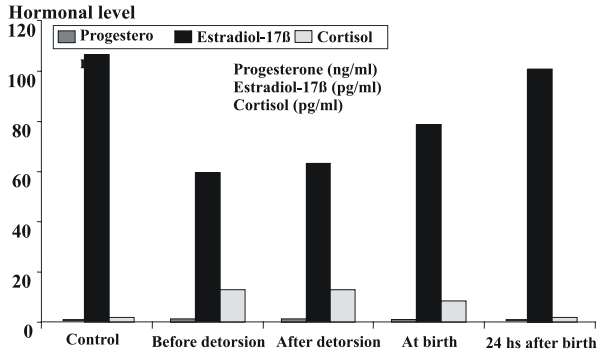

Figure 1: Plasma hormonal levels of the buffaloes suffering from uterine torsion (signif cant at level P<0.001)

(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 buf faloes (0.45±0.01 ng/ml), while it showed insigni f cant change at 24 hours after birth (0.48 ±0.02 ng/ml) as illustrated in *figure 1*. Highly signi f cant (P<0.001) decrease in the levels of estradiol-17ß 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 signif cant increase (P<0.001) in plasma level of cortisol in the af fected 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 signi f cant statistical change in the buf faloes 24 hours after birth (1.90 ±0.05 pg/ml) in comparison to the control animals (1.88±0.03 pg/ml).

DISCUSSION

Uterine torsion is a common condition causing dystocia in bovine. Its simple form (90°-180°) is readily corrected under f eld conditions, but some cases referred to speciality clinics tend to represent the more extreme forms of the condition [3]. 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 successfull rolling of the buffaloes around the longitudinal axis and vaginal delivery was signif cantly 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 buf faloes that could be successfully rolled and got ride of foeti was signi f cantly 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 [10,33,47]. 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 [3,25,57]. 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 [47,57]. In a previous study , in spite of repeated rolling; the torsion persisted and C.S had to be performed [6,9,36]. 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 [31], however; after detachment of adhesions, full detorsion was not possible in these 4 cases [51]. 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 f rst stage of labor and dilated cervix. The rates of bloody uterine dischar ge and rupture of foetal sacs were low with <90° and increased signif cantly with the severity of torsion. In some studies, maternal recovery rates should remain high unless severe toxemia or necrosis of the uterus has developed [3,47]. In cows, mortality rates ranged from 5 to 18% depending on whether the study was based on f eld or hospital cases [47,57]. 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 buf faloes 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 [3,47]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 [3,57]. 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 af fect the survival of the foetus, but in our opinion the amount of uterine vascularity is de f nitely a factor. Another study showed no evidence of ischemia or gangrene of the myometrium [44], whereas we have observed frequently a cyanotic uterus, especially in the more severe torsions which failed to be corrected prior to sur gery. The condition of the foetus appears to be more in f unced by the duration of the condition rather than severity of torsion, subsequently; some authors obtained between 44 to 58% fetal survival rates during the early uterine torsion [33,57]. The viability or survival rate is diff cult to be explained, but obviously some factors such as duration of the condition and severity of the torsion are major determinants of the outcome [57].

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 [44].

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 [44, 57]. 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 [47]. 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 [3,44], even in cases with intact membranes there may be already some placental separation and foetal hypoxia [3]. If the foetus is believed to be dead, release of the foetal fluids will reduce the weight of the uterus and facilitate manual detorsion [47]. On the growth examination of the gravid horn, which contained only one foetus, showed placental separation and severe haemorrhage due to venous congestion [7], 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 [1 1]. 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 [5] or due to the relatively large loss of blood during labour . Moreover , estradiol-17ß hormone plays an important role in the erythrocytic picture,which leads to hydraemia in the circulation [14] once estrogen possesses an inhibitory effect on the erythropoeisis [13,55]. 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 [63]. The obtained data for erythrogram come in agreement with anothers [19,20].

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 [20,27,63]. Moreover , leukocytosis and neutophilia were recorded in the affected mare with uterine torsion [37], as well as in sows at parturition [40].

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 [1l]. 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 anothers [16,26,39]. The increase of AST was necessary for accelerating the rate of metabolism and protein biosynthesis needed for foetal growth as well as milk production [3]. In addition, the increase in AST levels may be due to great muscular effort which is exerted during the process of calving [20] 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 [63]. On contrary , ALT determination showed non significant change in this work. Such result was supported by a previous finding [19]. In the same time, measurement of ALT activity in cattle is of little use in diagnosis of liver disease, however; AST is not liver specific as LDH [34].

Lactate dehydrogenase (LDH) is an intracellular enzyme, widely distributed in animal tissues and released following cellular damage [1 1]. 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 [26,35]. Moreover, the increased levels of enzymatic activities (AST and LDH) may be attributed to leakage of such substances from necrotic or damaged uterine cells [17]. Also, it was believed that the increase in these enzymes is related to high levels of progesterone during this period of pregnancy [52], or referred to the release of enzymes from the uterine muscles near the term [35]. On the other hand, non-significant change in LDH activity in cattle with dystocia was recorded in a previous study [4].

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 [18,52]. 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 [29] and their decrease postpartum was due to transfer of proteins into the colostrum. Moreover, hypoalbuminemia was probably associated with liver malfunction immediately after calving [48]. Similar results were obtained in mare [37], and in buffaloes [15,41]. 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 [32,53]. 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 [13].

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 [11] or may be due to stress condition and increased secretion of ACTH [29]. Moreover, the increased level of glucose in this study may be related to the increased level of cortisol which increase gluconeogenesis [43]. Also, [23] 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 [6,37].

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 [3]. 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 [30]. The present results are in coincidence with those reported in previous studies [32,37].

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-17ß 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-17ß were recorded respectively in affected buffaloes when compared to the control. These results are in agreement with those obtained [1,8,59] in buffaloes affected with uterine torsion as well as [4,64] in cattle with dystocia. Also ,our observations are in line with [38] who reported higher and lower concentrations of progesterone and estradiol-17ß 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 [24].

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 [60], 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 [58,6]. Similarly, [23] attributed the increased level of cortisol to stress condition in buffaloes affected by 180° to 360° uterine torsion.

In conclusion, 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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