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**NEW TRENDS REGARDING THE DIAGNOSIS,  
PROGNOSIS AND TREATMENT OF UTERINE TORSION  
IN BUFFALOES**  
(With 5 Tables)

By

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اتجاهات جديدة بشأن التشخيص وتوقع النتائج والعلاج لالتواء الرحم في الجاموس

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استخدم في هذا العمل عدد أربعة وعشرون من إناث الجاموس المصابة بالالتواء في الرحم وعشرة من الإناث ذات الولادة الطبيعية. تم جمع عينات الدم من الوريد الوداجي والشريان الصافي قبل الولادة مباشرة وبعد خمسة عشرة ساعة من الولادة من إناث الجاموس ذات الولادة الطبيعية وقبل وبعد خمسة عشرة ساعة من التعديل من إناث الجاموس المصابة بالالتواء الرحم. حيث تم تحديد التغيير في تركيز هرمون البروجيسترون في البلازما والمقاومة الإسموزية لكرات الدم الحمراء وحالة الأتزان القاعدي-الحامضي وضغط غازات الدم. ولقد أوضحت النتائج وجود علاقة وثيقة بين درجة تبلل المهبل والنتيجة المتوقعة لتعديل إلتواء الرحم. حيث وجد أن عملية تعديل التواء الرحم أفضل أن تتم فقط في إناث الجاموس ذات المهبل المتبلل بدرجة عالية كما لوحظ أن المشيمة يتم نزولها بسرعة في الإناث المصابة بالالتواء الرحم عن تلك التي بها ولادة طبيعية. كذلك لوحظ زيادة معنوية في تركيز البروجيسترون في البلازما في إناث الجاموس التي تعاني من التواء الرحم مع عدم فتح عنق الرحم بعد التعديل قبل العلاج عنه بعد حقن اليروستاجلاندين ف 2 ألفا و الديكساميسازون أو بنزوات الأسترايول لتلك الحالات وكذلك عن تلك الإناث التي تعاني من التواء الرحم مع فتح عنق الرحم وتلك للحالات ذات الولادة الطبيعية. لوحظ سيولة مبدئية للدم في المحلول الملحي عالي المقاومة لكلوريد الصوديوم بينما لوحظت سيولة عالية في المحلول الملحي قليل المقاومة لكلوريد الصوديوم في الإناث المصابة بالتواء الرحم عن تلك الإناث ذات الولادة الطبيعية. كما حدثت زيادة معنوية للسيولة المبدئية والسيولة العالية في المحلول الملحي عالي المقاومة لكلوريد الصوديوم في إناث الجاموس التي نفقت عن تلك التي استمرت حية بعد تعديل التواء الرحم. وقد وجدت أيضا زيادة معنوية في كلا من درجة تركيز الهيدروجين في الدم الشرياني (pHa) ، والضغط الجزئي للأوكسجين في الدم الشرياني (PaO<sub>2</sub>) والضغط الجزئي لثاني أكسيد الكربون في الدم الشرياني (PaCO<sub>2</sub>) وكذلك درجة تشبع الأوكسجين في الدم الشرياني (SaO<sub>2</sub>) ودرجة تشبع الأوكسجين في الدم الوريدي (SvO<sub>2</sub>) ونقص في الزيادة القاعدية (BE) والبيكربونات (HCO<sup>-3</sup>) في الحيوانات التي نفقت نتيجة إصابتها بالالتواء في الرحم عن تلك الإناث التي استمرت حية بعد تعديل إلتواء الرحم وكذلك الإناث ذات الولادة الطبيعية. كذلك وجد أنه بعد تعديل التواء الرحم يحدث نقص فجائي في الضغط الجزئي للأوكسجين في الدم الشرياني (PaO<sub>2</sub>) في الحيوانات التي استمرت حية بينما لم يتغير في الإناث التي نفقت. وقد استنتج من هذه الدراسة أن لف الحيوانات المصابة بالالتواء الرحم أفضل في الحالات التي يتم تشخيصها مبكراً (التي بها تبلل عالي في المهبل). كذلك يفضل حقن بنزوات الأسترايول لمساعدة في فتح عنق الرحم بعد تعديل التواء الرحم. كما تم استنتاج أيضا أن تحديد المقاومة الإسموزية لكرات الدم الحمراء وحالة الأتزان القاعدي- الحامضي وضغط غازات الدم يفيد في الحفاظ على حياة الأم والجنين عن طريق إعطاء بعض الأدوية التي تزيد مقاومة جدار كرات الدم الحمراء وكذلك إعطاء المحاليل الكافية للحيوان.

#### SUMMARY

Twenty four buffalo-cows suffering from uterine torsion and 10 normally calving buffaloes were used in the present work. Both arterial and venous blood were collected from the auricular artery and jugular vein, respectively. The blood samples were collected just before parturition and 15 hours later in normal parturient buffaloes, as well as immediately before and 15 hours after manipulation of uterine torsion in affected animals. The changes in plasma progesterone concentration, erythrocyte osmotic fragility, acid base status and blood gas tension were determined. The obtained results revealed a direct tightly relationship between the degree of moisture of the vagina and prognosis of torsion, where rolling of torsion affected buffaloes was indicated only in cases with high moisture of the vagina. The placenta of torsion affected buffaloes dropped rapidly than in normal parturient females. Moreover, the plasma progesterone content was significantly elevated in buffalo-cows suffered from uterine torsion with closed cervix before treatment than that recorded after injection of prostglandine  $F_{2\alpha}$  and dexamethasone or oestradiol benzoate and than that observed in females suffered from uterine torsion with open cervix and those with normal parturition. There was an initial haemolysis in higher saline strength and maximum haemolysis in lesser saline strength in torsion affected animals as compared to those observed in normal calving buffaloes. Both initial and maximum haemolysis occurred significantly in higher saline strength in buffaloes that died as compared with the survivors females after manipulation of uterine torsion. There was significant increase in arterial hydrogen ion concentration (pHa), partial arterial pressure of oxygen ( $PaO_2$ ), partial arterial pressure of carbon dioxide ( $PaCO_2$ ), partial venous pressure of oxygen ( $PvO_2$ ), arterial oxygen saturation ( $SaO_2$ ) and venous oxygen saturation ( $SvO_2$ ) and a decrease in base excess (BE) and actual bicarbonate of plasma ( $HCO_3^-$ ) in died torsion affected animals than that observed in both survivors females after manipulation of uterine torsion and normal parturient ones. Following manipulation of uterine torsion the partial arterial pressure of oxygen ( $PaO_2$ ) was sharply dropped in survivors animals and unchanged in died females. It could be concluded that the rolling of torsion affected buffaloes was preferable in cases with high moisture of the vagina. Injection of oestradiol benzoate is indicated in females with closed cervix after rolling. Determination of the erythrocyte osmotic fragility, acid base status and blood gas tension improved the chance of survival of dam and her fetus with injection of some drugs that strength the erythrocyte membrana and an adequate fluid and electrolyte therapy.

*Key words: Uterine torsion, buffaloes.*

#### INTRODUCTION

Dystocia due to uterine torsion is not rare and constitute a major cause of maternal dystocia in buffaloes (Singh, 1991a). The condition generally occurs as a complication of late- first stage or early second stage of labor (Arthur *et al.*, 1989 and Singh and Nanda, 1996). In torsion affected cases, the

animal may behave normally, or it may show colicky pains (kicking at the abdomen); exhibit variable degree of straining, the vulva or perinium may appear sunken or drawn into the pelvis, and the female may stand with the tail elevated, but no fetal parts or membranes appear through the vulva (Sloss and Dufty., 1980). They reported that the heart and respiratory rates are elevated and the rectal temperature may be slightly above normal.

Among the various causes of uterine torsion are the small amount of foetal fluids, uneven stable ground, confinement in stable for long period and violent movement during late pregnancy (Hazzaa *et al.*, 1987). They reported that the incomplete relaxation of the posterior birth canal in 30% of cases may predisposing factor for occurrence of uterine torsion. In addition to low uterine tone and weak broad ligament (Singh, 1991b), uterine torsion may be favoured by unequal contractions of the myometrium or by inordinate fetal movement, which are greatest during the first stage and early second stage of parturition (Arthur *et al.*, 1989). Uterus didelphus is consider as a cause of uterine torsion in buffaloes (Singh *et al.*, 1995). The direction of torsion is commonly right close wise (Zaki *et al.*, 1968, Shalaby, 1973 and Hazzaa *et al.*, 1987). On the other hand, Fouad and EL-Sawaf (1963) reported that in Egyptian buffaloes, torsion is mostly left sided. There was a various degree of uterine torsion including 90°, 180°, 270°, 360° and more than 360° in 10, 52, 28, 9 and 1% of cases, respectively (Frerking *et al.*, 1975). However, a torsion of more than 45° causes dystocia (Sloss and Dufty, 1980).

Resistant of erythrocytes to haemolysis may be increased or decreased in diseases and in metabolic dysfunctions (Schalm *et al.*, 1975). However, the influence of dystocia on red cell fragility has not been evaluated so far. Homeostatic balance in the body depends largely on the acid base balance of blood (Carlson, 1989). The cellular functions of the body could be disturbed with any alterations in blood pH (Robertson, 1989). Acid base parameters of the dams with normal parturition were in physiological range (Schlerka *et al.*, 1979; Mulling *et al.*, 1979 and Szenci, 1985a). In cases of dystocia, alterations in cardiopulmonary functions may lead to disturbances in acid base equilibrium of blood as a result of impaired tissue perfusion and impaired carbodioxide elimination (Szenci, 1985a and Gurtler *et al.*, 1989). There was very limited literature on acid base status and blood gas tension of normally calving and uterine torsion affected buffaloes (Ghuman *et al.*, 1998). Therefore, the present study was conducted to ascertain the condition of vagina, cervix and fetal membrane, in addition to the change on the acid base status, blood gas tension and osmotic fragility of erythrocytes as a monitor for prognosis of uterine torsion in buffaloes.

## MATERIAL and METHODS

### **Animals:**

Twenty four buffaloes suffering from uterine torsion belonged to some owners at Menoufia and Kalyoubia Provinces and 10 normal calving females belonged to the Faculty of Agriculture Farm (Moshtohor), Zagazig University - Benha were used in the present study. The torsion affected buffaloes were clinically observed for signs of colicky pain, anorexia, constipation, tempany and no rumination and the diagnosis of site, degree and direction of torsion was confirmed by vaginal and rectal examinations. In right torsion, the right broad ligament is pulled strongly downward and under the twisted uterine body and the left broad ligament is pulled tightly across over the top of the cervix, body of the uterus and vagina toward the right side and in counter-clock wise in left torsion in which the location of the two broad ligaments is reversed. The amount of tension on the broad ligaments and arteries indicate the severity of the torsion.

Uterine torsion occurred at full term of gestation in 20 buffaloes in which detorsion was achieved for 16 cases only by Schaffer modified method within 1 to 4 roles (Singh and Nanda, 1996). Caeserian section was indicated for the remaining 4 buffaloes. Torsion of the uterus occurred at 8-9 months of gestation for 4 buffaloes, in which caeserain section was indicated. In torsion affected buffaloes, the cervix was completely dilated in 7 cases and closed in 17 ones. Those buffaloes with closed cervix were treated either with intramuscular injection of 25 mg PGF<sub>2</sub>α "Lutalyse, Upjohn, Kalamazo, MI, USA" and 8 mg dexamethasone " Azium Schering Corp Kenil Worth, NJ" (n = 8) or intramuscular injection of 70 mg oestradiol benzoate "Folone, Misr company for Pharm. Ind. S.A.A." (n = 9) . About 1500 ml dextrose 5% and 500 ml normal saline 0.9% were injected intravenously for each animal suffered from uterine torsion.

The degree of moisture of the vagina; degree, site and direction of torsion; time of detection of torsion in relation to the expected time of parturition and condition of the cervix after detorsion were observed. Following detorsion or caesarian section and parturition, the sex, crown rump length and weight of feti, number of cotyledons, weight of placenta. Length and breadth of both pregnant and non-pregnant uterine horns were recorded at the 10<sup>th</sup> day postpartum. Also the number of dead buffaloes and dead born feti were observed.

### **Sampling:**

Both arterial and venous blood samples were collected from auricular artery and jugular vein, respectively. They were obtained just before parturition and during 15-hours postpartum in normal parturient buffaloes, and just before manipulation of uterine torsion and during 15-hours after its manipulation in

affected animals. The venous blood samples were divided into 3 portions; the first one was fresh blood samples used for determination of erythrocyte osmotic fragility (Schalm *et al.*, 1975). The 2<sup>nd</sup> portion was collected on heparinized vacutainer tubes and centrifuged (1500 rpm for 15 minutes), then plasma was separated and stored at - 20°C until progesterone assay using radioimmunoassay (El-Banna *et al.*, 1985 & 1986). The 3<sup>rd</sup> portion of venous blood in addition to the arterial blood were collected separately on heparinized vacutainer tubes and transferred in ice tank immediately within 1 - 3 hours after collection to the laboratory for determination of acid-base parameters (arterial hydrogen ion concentration "pHa", actual bicarbonate of plasma "HCO<sub>3</sub>" and base excess "BE") and blood gases (partial arterial pressure of oxygen "PaO<sub>2</sub>", partial arterial pressure of carbondioxide "PaCO<sub>2</sub>"; partial venous pressure of oxygen "PvO<sub>2</sub>", arterial oxygen saturation "SaO<sub>2</sub>" and venous oxygen saturation "SvO<sub>2</sub>") with blood gas analyzer "BMS<sub>3</sub>, MK<sub>2</sub>m Radiometer, Copenhagen) at 37°C.

**Statistical analysis:**

Data obtained were statistically analyzed using statistical analysis system (SAS) (1987).

**RESULTS**

As shown in Table 1 there was a direct tightly relationship between the degree of moisture of the vagina and prognosis of torsion. The rolling of the torsion affected buffaloes was indicated only in cases with high moisture of the vagina which indicates that the case was early diagnosed.

Table 2, revealed that, the drop of placenta in buffaloes affected with uterine torsion was more rapid than that observed in normal parturient one. The time needed for cervical dilatation in buffalo cows with uterine torsion accompanied with closed cervix was significantly shorter following administrations of oestradiol benzoate (6.31 hours), than that recorded after injection of dexamethazone and PGF<sub>2</sub> 24.73 hours).

As tabulated in table 3, the plasma progesterone profile was significantly increased in buffalo cows with closed cervix (5.43 - 5.98 ng/ml), than those with dilated cervix (1.51 ng/ml). Following manipulation of uterine torsion, the plasma progesterone content was significantly dropped in buffalo cows with closed cervix up to 1.38 - 1.58 ng/ml.

Table 4, revealed that the number of cotyledons were significantly increased in pregnant horn (85 and 90), than in non- pregnant horn (56.40 and 53.00) of normal parturient and torsion affected buffaloes, respectively. The length of cotyledons was significantly increased in pregnant horn of torsion affected buffaloes (78.00 mm), than in pregnant horn of normal parturient animals (61.01 mm ) and non pregnant horn of torsion affected females (61.34

mm). The shortest length was observed in non pregnant horn of normal parturient buffaloes (52.71 mm). Moreover, the maximum breadth of cotyledon was recorded in pregnant horn of torsion affected animals (53 mm) followed by that detected for the same horn in normal parturient females (46.45 mm) and non pregnant horn of torsion affected animals (45.63 mm). The shortest breadth was found in non pregnant horn of normal parturient buffaloes (40.86 mm). The crown rump length was significantly increased in torsion affected buffaloes with male foeti (83.53 cm), than those with female foeti (72.00 cm) and those in normal parturient females with male foeti (71.30 cm). The shortest crown rump length was observed in buffalo cows with normal parturition and female foeti (65.90 cm). The maximum weight was observed for male foeti born from torsion affected buffaloes (36.00 kg) which significantly higher than that observed in male foeti in normal parturient females (31.00 kg) and torsion affected ones with female foeti (29.00 kg). The minimum weight was detected in normal parturient buffaloes with female foeti (23.00 kg). The weight of placenta was not varied in normal parturient and torsion affected buffaloes.

In torsion affected animals, initial haemolysis occurred in higher saline strength (0.73%), however maximum haemolysis was observed in lesser saline strength (0.42%) as compared to normally calving buffaloes. By 15-hours post detorsion both initial and maximum haemolysis occurred significantly in higher saline strength in buffaloes that died (0.78 and 0.50) as compared with the survivors females after detorsion (0.68 and 0.32%).

As shown in table 5, there was a significant increase in arterial hydrogen ion concentration (pHa), partial arterial pressure of oxygen (PaO<sub>2</sub>), partial arterial pressure of carbon dioxide (PaCO<sub>2</sub>), partial venous pressure of oxygen (PvO<sub>2</sub>), arterial oxygen saturation (SaO<sub>2</sub>) and venous oxygen saturation (SvO<sub>2</sub>) and a decrease in base excess (BE) and actual bicarbonate of plasma (HCO<sub>3</sub>) in torsion affected females which died within 24 - 36 hours, than those observed in both survivors female after manipulation of uterine torsion and normal parturient ones. After manipulation of uterine torsion the partial arterial pressure of oxygen (PaO<sub>2</sub>) was sharply decreased in survivor animals and did not vary in died females.

#### DISCUSSION

The results of this study revealed that, there was a direct tightly relationship between the degree of moisture of the vagina and prognosis of torsion. The rolling of the animals must be indicated only in cases with high moisture of the vagina, which indicate that the case was early diagnosed and the cervix is completely dilated. Sloss and Dufty (1980) reported that the prognosis of uterine torsion depends on the severity and duration of the condition, where the greater the degree of the torsion and the longer the condition has existed the

more the uterus is embarrassed by ischemia. They added that immediately prior to the termination of pregnancy a marked changes were occur in the nature of vaginal mucus which is liquifies and finally assumes an appearance similar to that observed at estrus. Moreover, the rapid drop of placenta in buffaloes affected with uterine torsion than that observed in normal parturient females might be due to extensive degeneration or absence of basement membrane and uterine glands, in addition degeneration of propria, congestion, hemorrhages and thrombi in the propria and fragmentation of the myometrium (Malik *et al.*, 1990).

In 17 buffaloes subjected to detorsion, the cervix had failed to dilate. This might be explained by the higher progesterone concentrations (5.43 to 5.93 ng/ml) in such animals, suggesting that parturition had not yet been initiated (Matsas, 1993, Bugalia *et al.*, 1995 and Sosa and Agag, 1998). Moreover, the time needed for cervical dilatation in buffalo-cows with uterine torsion accompanied with closed cervix was significantly shorter following administrations of oestradiol benzoate, than that recorded after injection of dexamethasone and  $\text{PGF}_2\alpha$ . In this respect, an equivalent amount of a drug with an oxytocin-like action, is injected intramuscularly to restore myometrial tone and initiate active cervical dilatation (Sloss and Dufty, 1980)

In normal calving buffaloes, initial haemolysis evident at 0.66 NaCl solution while the maximum haemolysis of erythrocytes (85%) occurred at 0.47% NaCl on the day of parturition. Ahmed *et al* (1983) and Ghuman *et al* (1997) observed similar pattern in cattle and buffaloes around parturition. Significant alterations in estrogen and oxytocin around parturition, influence erythrocyte destruction (Singh and Singh, 1979), however progesterone stabilized the erythrocyte membrane (Devenuto *et al.*, 1969). In torsion affected animals, initial haemolysis occurred in higher saline strength (0.73%), however, maximum haemolysis was observed in lesser saline strength (0.42%) as compared to normally calving buffaloes. By 15-hours post-detorsion initial and maximum haemolysis occurred significantly in higher saline strength in buffaloes that died (0.78 and 0.50) as compared with the survivors (0.68 and 0.32%). This difference might be due to the destructive actions of enhanced prostaglandin and epinephrine on erythrocyte integrity (Allen and Rasmussen, 1971). Lowering of R.B.C.S. resistance is considered a bad signs for the dam after their manipulation of the torsion which render us to pay more attention and care to soften their life. It thus appears that erythrocytes were more fragile on the day of parturition in normally calving buffaloes and torsion of uterus further enhanced the erythrocyte fragility specially in buffaloes that died subsequently.

In normal calving buffaloes, the non significant increase in the pH accompanied with an increase in base excess (BE) and ( $\text{Hco}_3$ ) indicate

metabolic alkalosis (Ghuman *et al.*, 1998), however, carbon dioxide retention was increased slightly as a result of respiratory compensation (Cakala *et al.*, 1985 and Szenci, 1985b). Moreover, the oxygen tensions in arterial blood of normal parturient buffaloes did not show any appreciable change just before and after parturition. Venous and arterial saturation did not show any specific change indicating no oxygen abnormality (Ghuman *et al.*, 1998).

In buffaloes affected with uterine torsion the arterial pH were within normal range and remained unaltered immediately after detorsion. Variations in blood PaCO<sub>2</sub> immediately after detorsion were indication of a pneumatic hyperventilation as a result of increased physiological dead space. Even, the significant increase in PaCO<sub>2</sub> before and after manipulation of uterine torsion indicate bad signs of animals, so care must be attention toward such cases. This can be corroborated by the decreased PaO<sub>2</sub> values in both survivor animals "after manipulation of uterine torsion" and normal parturient ones "after birth". A drop in PaCO<sub>2</sub> immediately after detorsion might be attributed to hyperventilation owing to stress and pain of detorsion process (Ghuman *et al.*, 1998). They found also that the alteration in HCO<sub>3</sub><sup>-</sup> and BE suggesting compensatory efforts, five hours post detorsion and the values of acid base had improved as the animals were in the process of homeostasis. Siddiquee (1988) found sever metabolic acidosis torsion affected buffaloes. Buffaloes under stress at time of calving showed a distinct shift of acid base balance towards metabolic alkalosis (Szenci., 1985a). Early obstetrical maneuvers appeared to be useful in terms for acid base status (Eigenmann *et al.*, 1982 and Gurtler *et al.*, 1989). A change in oxygen between arterial and venous blood may reflect changes in oxygen delivery to tissue (Szenci, 1983). According to Gregg and Weiner (1993); Petraglia *et al.* (1993) and Jenkin *et al.* (2001) the increase numbers of dead feti in torsion affected animals with hypoxaemia might be due to possibility the increase Activin A and PGE<sub>2</sub> induced by hypoxaemia in dead feti, reflecting an increasing partial pressure of carbon dioxide and a decreasing partial pressure of oxygen.

From the present study, it could be concluded that the rolling of torsion affected buffaloes was preferable in cases with high moisture of the vagina. Estradiol benzoate is the best drug of choice to hasten cervical dilatation in females with closed cervix after rolling. Attention must be directed towards the administration of drugs that strength the erythrocyte membrane to avoid the erythrocytic fragility and subsequent death of dams. Detection of blood gas and acid base parameters in torsion affected buffaloes improved the chance of survival of dam and her fetus with an adequate fluid and electrolyte therapy.



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Table 1: condition of the vagina as a mirror for the prognosis of uterine torsion and indication of rolling.

Number of animals	Degree of moisture of the vagina	Degree of torsion	Site of torsion	Direction of torsion	Time of detection in relation to the expected time of birth	Condition of the cervix after detorsion	Prognosis	Manipulation
3	+++	90	Pre-cervical	Left	at parturition	Completely dilated	Very good	Rolling
3	+++	180	Pre-cervical	Right	12 hours before parturition	Completely dilated	Very good	Rolling
2	+++	360	Cervical	Right	12 hours before parturition	Completely dilated	Very good	Rolling
9	++	360	Cervical	Right	24-36 hours before parturition	Closed	Not good	Rolling
4	+	180	Cervical	Right	72 hours before parturition	Closed	Poor	Caesarian
3	0	180	Cervical	Right	14-21 days before parturition	Closed	Poor	Caesarian
1	0	360	Cervical	Right	21 days before parturition	Closed	Poor	Caesarian

(+++ ) great amount of fluids (++) moderate amount of fluids (+) little amount of fluids (0) dry.

Table 2: Time elapsed for cervical dilatation, in buffalo- cows with normal parturition and those after detorsion (M± SE).

	With normal parturition (n=10)	Females after detorsion of the uterus	
		With dilated cervix (n=7)	With closed cervix
Time of complete cervical dilatation (hours)	-	-	Treated with PGF <sub>2</sub> and dexamethazone (n=8) 6.31±0.93 <sup>b</sup>
Time of drop of placenta (minutes)	560.37±30.78 <sup>a</sup>	10.12± 2.18 <sup>b</sup>	14.68±3.51 <sup>b</sup> 11.46±1.84 <sup>b</sup>

Means with different superscripts in each category are significantly different from each other at level (p<0.05).

Table 3: Plasma progesterone profile before and after detorsion in buffalo cows with uterine torsion as compared with those with normal parturition (M± SE)

	n	Plasma progesterone content (ng/ml)	
		Before manipulation of uterine torsion	After manipulation of uterine torsion
Buffaloes With uterine Torsion	7	1.51±0.53 <sup>b</sup>	1.44±0.58 <sup>b</sup>
	8	Treated with PGF <sub>2</sub> and dexamethasome	5.43±1.42 <sup>a</sup>
		Treated with oestradiol benzoate	1.38±0.46 <sup>b</sup>
Buffaloes with normal parturition	9	5.93±1.98 <sup>a</sup>	1.58±0.62 <sup>b</sup>
	10	1.48.0.56 <sup>b</sup>	

Means with different superscripts are significantly different from each other at level (P<0.05).

Table 4: foetal and foetal membranes characteristics in normal and torsion affected buffaloes (M± SE).

Sex of the calf	Normal parturient buffaloes (n=10)		Torsion affected buffaloes (n=24)	
	Female	Male	Female	Male
No. of oviducts	85.00 ± 8.31 <sup>a</sup>		90.00 ± 7.38 <sup>a</sup>	
Gravid horn	56.40 ± 4.61 <sup>b</sup>		53.00 ± 3.45 <sup>b</sup>	
Non gravid-horn	61.01 ± 1.34 <sup>b</sup>		78.00 ± 1.77 <sup>a</sup>	
Pregnant	52.71 ± 3.42 <sup>c</sup>		61.34 ± 1.50 <sup>b</sup>	
Non pregnant	46.45 ± 2.36 <sup>ab</sup>		53.00 ± 3.55 <sup>a</sup>	
Breadth of uterine horn (mm)	40.86 ± 5.31 <sup>b</sup>		45.63 ± 3.37 <sup>ab</sup>	
Non pregnant	71.30 ± 1.34 <sup>c</sup>		8.53 ± 2.31 <sup>a</sup>	
Crown	31 ± 1.31 <sup>b</sup>		36 ± 1.34 <sup>a</sup>	
Length (cm)	65.90 ± 2.63 <sup>c</sup>		72.00 ± 1.31 <sup>b</sup>	
Female	23 ± 2.31 <sup>c</sup>		2.90 ± 1.37 <sup>b</sup>	
Male	44.00 ± 20.33 <sup>a</sup>		46.00 ± 15.41 <sup>a</sup>	
Female				
Weight of Placenta (g)				

Means with different superscripts in each category are significantly different from each other at level (P<0.05).  
Dead feti born after manipulation of uterine torsion (n=9).

Table 5: Acid base status and blood gas tension in both torsion affected buffaloes (survivors and died) and normal Parturient ones (M ± SE).

pH	Torsion affected buffaloes (n=24)				Normal parturient buffaloes (n=10)			
	Survivors (n=20)		Died (n=4)		Survivors (n=10)		Died (n=0)	
	Before	After	Before	After	Before	After	Before	After
pH	7.39 ± 0.03 <sup>b</sup>	7.37 ± 0.03 <sup>b</sup>	7.69 ± 0.03 <sup>a</sup>	7.78 ± 0.04 <sup>a</sup>	7.43 ± 0.06 <sup>b</sup>	7.43 ± 0.06 <sup>b</sup>	7.35 ± 0.03 <sup>b</sup>	7.35 ± 0.03 <sup>b</sup>
P <sub>a</sub> CO <sub>2</sub> (mm Hg)	29.89 ± 3.00 <sup>f</sup>	31.76 ± 2.65 <sup>e</sup>	49.31 ± 1.49 <sup>a</sup>	51.75 ± 3.23 <sup>a</sup>	39.78 ± 0.42 <sup>b</sup>	39.78 ± 0.42 <sup>b</sup>	36.59 ± 1.82 <sup>bc</sup>	36.59 ± 1.82 <sup>bc</sup>
BE (mmol/L)	-4.31 ± 2.53 <sup>c</sup>	-0.47 ± 0.13 <sup>b</sup>	-8.13 ± 0.51 <sup>a</sup>	-9.74 ± 0.14 <sup>a</sup>	-3.45 ± 0.43 <sup>b</sup>	-3.45 ± 0.43 <sup>b</sup>	-0.73 ± 0.17 <sup>b</sup>	-0.73 ± 0.17 <sup>b</sup>
HCO <sub>3</sub> <sup>-</sup> (mmol/L)	23.13 ± 3.35 <sup>a</sup>	23.45 ± 1.52 <sup>a</sup>	16.71 ± 1.11 <sup>b</sup>	17.75 ± 1.37 <sup>b</sup>	27.60 ± 2.42 <sup>a</sup>	27.60 ± 2.42 <sup>a</sup>	24.25 ± 1.53 <sup>b</sup>	24.25 ± 1.53 <sup>b</sup>
P <sub>a</sub> O <sub>2</sub> (mm Hg)	129.33 ± 10.34 <sup>a</sup>	98.99 ± 8.18 <sup>b</sup>	133.40 ± 13.15 <sup>a</sup>	134.34 ± 10.21 <sup>a</sup>	110.09 ± 10.31 <sup>ab</sup>	110.09 ± 10.31 <sup>ab</sup>	97.88 ± 10.35 <sup>b</sup>	97.88 ± 10.35 <sup>b</sup>
P <sub>v</sub> O <sub>2</sub> (mm Hg)	54.13 ± 4.45 <sup>b</sup>	47.33 ± 4.39 <sup>b</sup>	72.13 ± 6.33 <sup>a</sup>	73.97 ± 7.19 <sup>a</sup>	44.31 ± 4.30 <sup>b</sup>	44.31 ± 4.30 <sup>b</sup>	43.95 ± 4.06 <sup>b</sup>	43.95 ± 4.06 <sup>b</sup>
SaO <sub>2</sub> (%)	100.31 ± 8.48 <sup>c</sup>	97.65 ± 7.06 <sup>c</sup>	139.30 ± 10.40 <sup>a</sup>	145.28 ± 17.77 <sup>a</sup>	97.60 ± 8.31 <sup>b</sup>	97.60 ± 8.31 <sup>b</sup>	96.73 ± 9.58 <sup>b</sup>	96.73 ± 9.58 <sup>b</sup>
vO <sub>2</sub> (%)	88.35 ± 8.48 <sup>b</sup>	83.50 ± 8.72 <sup>b</sup>	123.31 ± 11.54 <sup>a</sup>	117.25 ± 9.92 <sup>a</sup>	79.31 ± 8.45 <sup>b</sup>	79.31 ± 8.45 <sup>b</sup>	73.66 ± 8.04 <sup>b</sup>	73.66 ± 8.04 <sup>b</sup>

Means with different superscripts in each category are significantly different from each other at level (P<0.05).  
In torsion affected buffaloes, death of some cases (n = 4) occurs within 24 – 36 hours after manipulation of uterine torsion.