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Effect of Meloxicam on Prognostic Factors/Indices like Sodium, Potassium and Chloride Concentration in Dystocia Affected Bovines

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ABSTRACT

Investigation was carried out to find out the efficacy of meloxicam, a non-steroial anti-inflammatory drug, as stress modulater in bovine dystocia cases and to determine probable prognostic indices in cases of assisted parturitions. The study was conducted on 41 buffaloes affected with dystocia. The animals included in the investigation were randomly divided into two groups. To study the effect of preemptive administration of non sterioidal anti-inflammatory analgesics on stress perception by the animal experiencing difficult birth, meloxicam was administered @ 0.5mg/kg b.wt. in 22 buffaloes (Group II) 15 minutes prior to obstetrical management of the case.

Significant difference was not observed in plasma sodium and potassium levels between surgically and non surgically treated buffaleos. A significant decrease in chloride concentration by 24 hours post treatment was evident in buffaloes without preemptive administration of meloxicam. The chloride concentration was significantly lower in surgically treated buffaloes than the non-surgically treated ones. Post treatment chloride concentration was found to be related with the survival of the animal, the levels were significantly lower in those which died than the ones which survived the treatment.

Key words: *Modulater, Buffaloes, Non-steroial, Anti-inflammatory*

INTRODUCTION

Dystocia is defined as delayed or difficult calving, sometimes requiring significant human assistance.[1]. It generally has alower incidence in buffalo but still has a considerable impact on buffalo production (1-2%) [2]. However, Khan *et al.*[2] analyzed the incidence of abnormal calvings in buffalo in various reports and found it to be between 5.6-12.6% in Murrah, 8.94% in Jaffarabadi and between 4.6 to 5.4% in Surti buffalo.

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The reasons for such a low incidence in buffalo could be due to anatomical differences between cattle and buffalo. Buffalo have a more capacious pelvis, larger area of ileum, a free and easily separable fifth sacral vertebra, easily dilatable small sized vaginal canal, and elongated and wide apart vulvar lips. These anatomical differences mean that the first and second stages of labor in the buffalo can easily be completed within 20-70 min. A large number of risk factors for dystocia have been identified.

Dystocia is accompanied by several hematological, blood biochemical and endocrinological changes which have a significant bearing on the outcome of the case and may serve as prognostic indicators. In order to avoid the economic losses to the farmers it is desired that the prognosis of the dystocia cases be properly assessed before undertaking treatment.

Environmental stress exerts pronounced effects on the various biochemical characteristics of blood Maintenance of normal level of blood electrolytes is essential for normal growth, reproduction and health of animals. The electrolytes play a great role in maintenance of fluid balance and body's acid base balance. Keeping all these points in view this study was conducted to see the effect of meloxicam on prognostic factors/indices like sodium, potassium and chloride concentration in dystocia affected bovines.

MATERIAL AND METHODS

The present investigation was carried out on 41 dystocia affected buffaloes brought to the teaching veterinary clinics, CCS HAU, Hisar for treatment. Before attempting to relieve the dystocia, a complete history of the case with regard to parity, stage of gestation, duration of problem and previous handling of the case by the field staff/laymen, was obtained from the owner.

The nature and cause of dystocia was determined on the basis of systemic examination and depending upon the cause of difficulty in birth and the duration and pervious handling of the case, obstetrical management was carried out. All the animals received routine supportive therapy consisting of parentral antibiotics, dexamethasone, fluid therapy, hemostatic, uterine stimulants and intrauterine antiseptics post-delivery of the foetus.

Grouping on the basis of obstetrical operation:

Group-I: comprised of 19 buffaloes in which foetus were removed by Caesarian section without administration of meloxicam prior to surgery.

Group II: was comprised of 22 caesarean operated buffaloes treated preemptively with meloxicam.

Sub-grouping on the basis of obstetrical operation:

Group-I_A consisted of 8 buffaloes in which dystocia were relieved by non-surgical techniques and without pre-emptive administration of meloxicam.

Group-I_B comprised of 11 buffaloes in which foetus was removed by laparohysterotomy without administration of meloxicam prior to surgery.

Group II_A included 8 meloxicam administered dystocia affected buffaloes treated non-surgically.

Group II_B was comprised of 14 caesarean operated buffaloes treated preemptively with meloxicam.

Sub grouping on the basis of survival of dam following obstetrical management:

Group S consisted of 24 buffaloes which survived following treatment.

Group D included 17 buffaloes which died during or after obstetrical operation.

Groups S_I and S_{II} consisted of 13 and 11 buffaloes respectively which survived without/with preemptive administration of meloxicam.

Groups D_I and D_{II} were composed of six and 11 buffaloes respectively which died following obstetrical intervention without/with administration of meloxicam.

Groups S_B and D_B included 12 and 13 caesarean operated buffaloes respectively which survived or died following operation, Irrespective of treatment with Meloxicam.

SAMPLING SCHEDULE

Jugular blood samples were collected by standard venipuncture technique from all the cases before treatment (0hour) and then at 2 hours and 24 hours post-maneuvering. 20ml blood was collected in heparinised glass tubes. Serum was separated and various biochemical parameters were estimated. i.e. Sodium, Potassium and Chloride.

Sodium and Potassium

Concentration was determined by flame photometry following the method described by Oser[3].

The Chloride content of the blood plasma was estimated by Ferric Thiocynate method described by Zall *et al*.[4] using RA – 50 chemistry analyzer.

RESULTS

Sodium, potassium and chlorides play a crucial role in maintaining body acid-base balance as well as osmotic pressure in body fluids. These processes are the result of synergetic action of all three elements, and the role of each individual component is difficult to define without knowing and taking into consideration the other two elements. The maintenance of this value is determined by three major factors – balance and ratio of electrolytes in feed, endogenous acid production and level of renal activity. Electrolyte imbalance is quite rare, since body's buffering system provides maintenance of normal physiological pH value. In our study we analysed the concentration of Sodium, potassium and chloride in Dystocia affected buffaloes in serum samples collected prior to meloxicam administration and after surgical process. The detail is given below.

SODIUM AND POTASSIUM

Plasma electrolytes such as sodium and potassium were not significantly altered following treatment of dystocia in any of the groups. The levels of these electrolytes have been presented in Table 1 and 2. Pre-emptive administration of meloxicam did not have significant effect on sodium and potassium levels as significant difference was not observed between meloxicam treated and untreated buffaloes at any sampling interval except that the sodium level was significantly ($P<0.05$) lower in caesarean operated meloxicam administered buffaloes at 24hours post caesarean as compared to those operated without administration of meloxicam.

Blood plasma sodium and potassium concentrations were not significantly different between surgical and non surgical groups (Tables 3 and 4) except that in group II the sodium levels were found to be significantly ($p<0.05$) higher at 24hr in buffaloes without surgical intervention (Group IIA) as compared to operated buffaloes (Group IIB). Not only this the buffaloes which survived following treatment of dystocia and those which didn't survive had almost similar sodium and potassium profile which is apparent from the data presented in Tables 5 and 6.

CHLORIDE

Marked differences were recorded in the Plasma chloride concentration between meloxicam administered and un-administered buffaloes which have been shown in Table 7. The chloride levels at 24 hours post treatment (80.665±4.311 mEq/L) were significantly ($p<0.05$) decreased in buffaloes not administered meloxicam, when compared with the pre-treatment levels (101.962±3.751 mEq/L). However, no such decline was observed in buffaloes preemptively treated with meloxicam. The chloride level at 24 hours interval were also found to be significantly higher in meloxicam treated buffaloes (99.886±3.726 mEq/L) than the untreated ones (80.665±4.311 mEq/L). Similar observations were recorded in caesarean operated buffaloes too, Effect of caesarean section on plasma chloride concentration has been depicted in Table 8. The chloride concentration was observed to be significantly ($p<0.05$) decreased at 24 hours post-caesarean as compared to the pre-treatment (0 hour) concentration in buffaloes of (Group IB) and also in comparison to the values at identical interval in non-surgically treated buffaloes. The chloride concentration in groups IA and IB at 24 hours interval were recorded as 97.57±5.250 m Eq/L and 77.452±3.670 m

Eq/L respectively where as the concentration in Groups IIA and IIB were found to be 110.887±3.954 and 92.575±4.124 mEq/L respectively.

Post-treatment chloride concentration was found to have an important bearing on survival of dystocia affected buffaloes. The chloride concentration at different intervals in surviving buffaloes and in those which died following obstetrical management of the case have been shown in Table 9. The mean plasma chloride concentration was recorded to be significantly ($p<0.05$) higher at 2 hours post-treatment in the surviving buffaloes when compared with the values in those which ultimately died. This was true in all the treatment groups.

The plasma chloride levels at 2 hours post-treatment were either similar to or higher than the pre-treatment levels in surviving buffaloes but were lower than the pre-treatment levels in buffaloes which died after treatment.

Table 1: Effect of pre emptive administration of Meloxicam on plasma Sodium concentration tin Dystocia affected buffaloes

Group	Sampling interval Sodium (m Eq / Lt.)		
	0 hour	**2 hours**	**24 hours**
I (n=19)	140.453 ± 3.145	136.068 ± 6.98	139.063 ± 3.042
II (n=22)	133.659 ± 3.189	132.967 ± 4.772	132.479 ± 4.184
I A (n=8)	141.487 ± 5.447	138.925 ± 5.891	139.999 ± 5.006
II A (n=8)	141.538 ± 3.672	141.350 ± 5.457	144.314 ± 3.090
I B (n=11)	139.700 ± 3.939	133.991 ± 10.037	142.055 ± 3.730
II B (n=14)	128.857 ± 4.015	128.015 ± 6.753	126.100 ± 5.511*****

***** Significantly ($P<0.05$) different between groups at same interval

Table 2: Effect of pre emptive administration of Meloxicam on plasma Potassium concentration in Dystocia affected buffaloes

Group	Sampling interval Potassium (m Eq / Lt.)		
	0 hour	**2 hours**	**24 hours**
I (n=19)	3.335 ± 0.188	3.151 ± 0.215	3.376 ± 0.253
II (n=22)	3.194 ± 0.144	3.190 ± 0.174	3.419 ± 0.213
I A (n=8)	3.253 ± 0.332	3.140 ± 0.293	2.868 ± 0.274
II A (n=8)	3.253 ± 0.332	3.140 ± 0.293	2.841 ± 0.315
I B (n=11)	3.485 ± 0.204	3.159 ± 0.316	3.746 ± 0.358
II B (n=14)	3.00 ± 0.151	3.046 ± 0.186	3.254 ± 0.301

Table 3: Effect of Obstetrical operation on plasma Sodium concentration in Dystocia affected Buffaloes

Group	Sampling interval Sodium (m Eq / Lt.)		
	0 hour	**2 hours**	**24 hours**
I A (n=8)	141.487 ± 5.447	138.925 ± 5.891	139.999 ± 5.006
I B (n=11)	139.700 ± 3.939	133.991 ± 10.037	142.055 ± 3.730
II A (n=8)	141.538 ± 3.672	141.350 ± 5.457	144.314 ± 3.090
II B (n=14)	128.857 ± 4.015	128.015 ± 6.753	126.100 ± 5.511*****

***** Significantly ($P<0.05$) different between groups at same interval

Table 4: Effect of Obstetrical operation on plasma potassium concentration in Dystocia affected Buffaloes

Group	Sampling interval Potassium (m Eq / Lt.)		
	0 hour	**2 hours**	**24 hours**
I A (n=8)	3.253 ± 0.332	3.140 ± 0.293	2.868 ± 0.274
I B (n=11)	3.485 ± 0.204	3.159 ± 0.316	3.746 ± 0.358
II A (n=8)	3.253 ± 0.332	3.140 ± 0.293	2.841 ± 0.315
II B (n=14)	3.00 ± 0.151	3.046 ± 0.186	3.254 ± 0.301

Table 5: Observation on plasma Sodium concentration and survivability in different groups of Dystocia affected buffaloes

Group	Sampling interval Sodium (m Eq / Lt.)		
	0 hour	**2 hours**	**24 hours**
S (n=24)	136.137 ± 3.011	135.729 ± 3.511	135.26 ± 3.11
D (n=17)	137.80 ± 3.59	132.506 ± 8.136	136.36 ± 4.80
S I (n=13)	140.22 ± 3.27	138.130 ± 4.01	138.57 ± 3.11
D I (n=6)	140.95 ± 7.54	131.60 ± 18.66	140.11 ± 7.39
S II (n=11)	131.30 ± 5.09	132.89 ± 6.12	131.35 ± 5.67
D II (n=11)	136.081 ± 3.94	133.05 ± 7.76	133.85 ± 653
S B (n=12)	128.566 ± 4.241	127.622 ± 5.20	129.375 ± 5.017
D B (n=13)	138.300 ± 3.922	133.883 ± 10.516	137.416 ± 5.551

Table 6: Observation on plasma Potassium concentration and survivability in different groups of Dystocia affected buffaloes

Group	Sampling interval Potassium (m Eq / Lt.)		
	0 hour	**2 hours**	**24 hours**
S (n=24)	3.337 ± 0.139	3.253 ± 0.142	3.20 ± 0.140
D (n=17)	3.148 ± 0.197	3.049 ± 0.265	3.706 ± 0.35
S I (n=13)	3.48 ± 0.204	3.23 ± 0.206	3.20 ± 0.18
D I (n=6)	3.018 ± 0.392	2.97 ± 0.54	3.74 ± 0.71
S II (n=11)	3.168 ± 0.182	3.27 ± 0.204	3.206 ± 0.220
D II (n=11)	3.22 ± 0.230	3.095 ± 0.297	3.678 ± 0.387
S B (n=12)	3.220 ± 0.215	3.084 ± 0.227	3.129 ± 0.201
D B (n=13)	3.206 ± 0.161	3.110 ± 0.270	3.836 ± 0.401

Table 7: Effect of pre emptive administration of Meloxicam on plasma Chloride in Dystocia affected buffaloes

Group	Sampling interval Chloride (m Eq / Lt.)		
	0 hour	**2 hours**	**24 hours**
I (n=19)	101.962 ± 3.751^{a}	95.693 ± 4.969^{a}	80.655 ± 4.311^{b}
II (n=22)	97.493 ± 2.811	106.946 ± 5.697	99.886 ± 3.726*****
I A (n=8)	105.274 ± 5.988	106.224 ± 3.272	97.571 ± 5.250
II A (n=8)	98.507 ± 3.203	122.331 ± 12.392	110.887 ± 3.954
I B (n=11)	99.556 ± 4.919^{a}	88.354 ± 7.406^{ab}	77.452 ± 3.670^{b}
II B (n=14)	96.851 ± 4.131	97.511 ± 3.544	92.575 ± 4.124*****

Means bearing different superscripts differ significantly at different interval

***** Significantly (P<0.05) different between groups at same interval

Table 8: Effect of Obstetrical operation on plasma Chloride concentration in Dystocia affected Buffaloes

Group	Sampling interval Chloride (m Eq / Lt.)		
	0 hour	**2 hours**	**24 hours**
I A (n=8)	105.274 ± 5.988	106.224 ± 3.272	97.571 ± 5.250
I B (n=11)	99.556 ± 4.919^{a}	88.354 ± 7.406^{ab}	77.452 ± 3.670b*
II A (n=8)	98.507 ± 3.203	122.331 ± 12.392	110.887 ± 3.954
II B (n=14)	96.851 ± 4.131	97.511 ± 3.544*	92.575 ± 4.124*

Means bearing different superscripts differ significantly at different interval

***** Significantly (P<0.05) different between groups at same interval

Table 9: Observation on plasma Chloride concentration and survivability in different groups of Dystocia affected buffaloes

Group	Sampling interval Chloride (m Eq / Lt.)		
	0 hour	**2 hours**	**24 hours**
S (n=24)	102.325 ± 3.152	112.495 ± 4.60	93.390 ± 4.246
D (n=17)	95.665 ± 3.174	85.258 ± 4.348******	85.919 ± 4.764
S I(n=13)	105.708 ± 4.31	105.60 ± 3.95	83.13 ± 5.47
D I(n=6)	93.84 ± 6.66	74.21 ± 8.07*****	75.27 ± 6.90
S II(n=11)	98.32 ± 4.52	120.63 ± 8.46	105.50 ± 4.57
D II(n=11)	96.659 ± 3.54	91.88 ± 3.96******	93.017 ± 5.52
S B(n=12)	103.401 ± 4.861	104.077 ± 4.199	89.205 ± 3.408
D B(n=13)	93.105 ± 3.624	82.183 ± 5.220******	82.076 ± 5.266

***** Significantly (P<0.05) different between groups at same interval

****** Significantly (P<0.01) different between groups at same interval

DISCUSSION

Electrolytes, specifically Sodium, Potassium and Chloride are critical to ensure the biochemical balance of the environment in the water in and around the cell is maintained. This balance is known as the acid base balance (pH), if this balance is disturbed, animals lose their ability to regulate deep body temperature. This has a direct and immediate impact on a performance and potential mortality. Depletion of water and key electrolytes in and around the cell also creates dehydration, this leads to performance loss and death. The present investigation was carried out on 41 dystocia affected buffaloes brought to the teaching veterinary clinics, CCS HAU, Hisar for treatment, blood samples were collected and analysed to study the effect of Meloxicam on Sodium , Potassium and Chloride as prognostic indices.

No significant alteration was recorded in plasma sodium and potassium concentration following caesarean section or non surgical management of dystocia cases in present study. This is an agreement with observations of Manju[5] and Khatri[6] who reported that the plasma sodium and potassium concentration did not change significantly following caesarean section in buffaloes with uterine torsion. Devender Kumar[7] concluded that neither caesarean section nor detorsion by rolling the dam had any influence on plasma sodium and potassium concentration in uterine torsion affected buffaloes. Sevicik *et al.*[8] too did not detect any important change in blood sodium and potassium levels during early puerperium in cows delivered by caesarean section. Varshney *et al.*[9] noticed no significant difference in sodium and potassium concentration in dystocia affected cows upto 24 hours post caesarean as compared to the pretreatment values.

Contrary to this, Skydsgaard[10] concluded that plasma electrolyte changes following laparohysterotomy were similar to those described for post surgical human patients with decline in potassium concentration as the most significant change. Verma and Tyagi[11] noted fall in plasma sodium and potassium concentration after caesarean section in normal goats. Also there was no significant difference in sodium and potassium levels between surgically and non surgically treated buffaloes in the present study.

Devender Kumar[7] recorded no significant difference between surgically and non surgically treated buffaloes as far as sodium concentration is concerned but the potassium concentration were significantly lower at 24 hours post caesarean than the buffaloes treated by non surgical detorsion of uterus. Difference in sodium levels at 24 hours interval between caesarean operated and non surgically handled dystocia cases with preemptive administration of meloxicam in the present study, though statistically significant is of little biological significance.

The plasma profile of sodium and potassium is the net result of complex

interplay between different hormones such as aldosterone, adreno-corticotropic hormone and anti-diuretic hormone and the alterations in homeostasis as a result of effect of stress on renin-angiotensin system in the body of the animal.

Theoretically, the increased secretion of aldosterone following operative stress[12] or as consequence of ACTH release[13] should result in an increase in plasma sodium levels and decrease in potassium as aldosterone is responsible for renal conservation of sodium ions by promoting the process of their tubular reabsorption and increased excreation of potassium ions in the urine[14,15,16]. But since trauma is also known to be accompanied by an exaggerated secretion of anti-diuretic hormone.[13,17] the water retention due to oligouric effect of ADH results in dilution of sodium ions which has been conserved under the influence of aldosteron and also it leads to lesser excretion of potassium ions in the urine. The collective effects of both these processes may account for the maintenance of near status quo of the blood plasma sodium and potassium concentration following caesarean section or rolling/mutation in dystocia affected buffaloes.

There was no significant difference in plasma sodium and potassium concentration between buffaloes which survived and those which didn't survive following treatment of dystoria. Similar observations were recorded by Khatri[6]. It seems that the dystocia affected buffaloes in the present study were in perfect homeostasis as far as these electrolytes are concerned. Perhaps other factors were responsible for the death of these animals.

Preemptive administration of meloxicam had no effect on plasma levels of sodium and potassium. No such investigation has been done by any other worker to compare or contrast with our finding. Significant difference in plasma sodium levels at 24 hours post caesarean in meloxicam administered buffaloes in comparison to non administered group is not of any biological significance as the difference is primarily because of difference in pretreatment concentrations of the two groups.

Significant decline was registered in plasma chloride concentration within 24 hours of caesarean section/ treatment in dystocia affected buffaloes in the present investigation. The levels in the nonsurgically treated buffaloes were higher than the caesarean operated ones. This confirms the earlier observation by Devender[7] in this regard. However, Khatri[6] found no significant difference in chloride level after caesarean section in uterine torsion affected buffaloes. Verma and Tyagi[11] recorded significant fall in chloride levels within 12 hours of caesareotomy in goats. The drop in plasma chloride concentration after caesarean operation might have occurred consequent to post operative stress[18].

Singh and Amresh Kumar[19] reported that the surgical stress resulted in decline in chloride concentration with in one hour of surgery in buffalo calves which persisted during first three days. They maintained that the alterations in homeostasis as a result of effect on renin-angiotensin system in operated animals caused disturbance in electrolyte metabolism. Plasma chloride concentration have been reported to be significantly lower in dystocia affected cows undergoing caesarean section as compared to the healthy controls[9]. Contrarily, Spencer *et al.*[20] noticed that the chloride concentration remained within or near normal range in cows suffering with hydrops of foetal membranes and treated either by induction of parturition or caesarean section.

Higher chloride concentration in non surgically handled dystocia cases than the operated ones in the present study reflects that the animals in the later group were under greater degree of stress. This is corroborated by our observation on circulating cortisol levels in caesarean operated buffaloes. According to Gius[21], the hormonal response which govern the electrolyte balance parallel the severity of stress.

Buffaloes which died following treatment of dystocia were found to have significantly ($P<0.01$) lower chloride concentration at 2 hours post treatment interval than those which survived in our study. This is

in tune with the findings of Khatri[6] and strengthens the belief that higher degree of stress is associated with decrease in chloride levels in blood. The observations on plasma cortisol concentration in relation to survival of the dam in the present investigation further lend support to this view.

The interesting and important observation in the present investigation had been that the decrease in chloride concentration after caesarean section was seen only in buffaloes without preemptive administration of meloxicam and that the buffaloes which had been administered meloxicam prior to obstetrical management had significantly ($P<0.05$) higher chloride levels at 24 hours post treatment interval. This is hard to explain in the absence of any significant influence of meloxicam administration on circulating cortisol levels.

CONCLUSION

Maintenance of water-electrolyte homeostasis, both during pregnancy and postpartum period, is essential to keep mother's health and to maintain proper development of embryo/fetus and newborn calf. That is why it is very important to monitor changes in concentration of main electrolytes of body fluids, such as sodium, potassium and chlorides and resulting blood plasma molality.[22]

In our study, Plasma sodium and potassium levels were not significantly changed following relief of dystocia, nor did meloxicam administration have any significant effect on the level of these electrolytes.

Buffaloes which died or survived following treatment of dystocia had similar sodium and potassium profile.

A significant decrease in chloride concentration by 24 hours post treatment was evident in buffaloes without preemptive administration of meloxicam. The chloride concentration was significantly lower in surgically treated buffaloes than the non-surgically treated ones. Post treatment chloride concentration was found to be related with the survival of the animal, the levels were significantly lower in those which died than the ones which survived the treatment. Further studies is required to know more about corrrelation of Chloride administration in survivability of bovines at last stage of animal.

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