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Effects of Detomidine on Blood Chemistry and Electrolyte Profile in Buffalo Calves

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ABSTRACT

This experiment was designed to evaluate the effects of detomidine (a novel veterinary sedative and analgesic) on blood chemistry and electrolyte profile in buffalo calves. For this purpose, 10 buffalo calves were used and detomidine was injected intravenously at the dosage rate of 50 μg/kg body weight. Blood and urine samples were collected before drug administration and then 30, 60 and 90 minutes post injection. The results indicated that there was no significant change in the blood chemistry and electrolyte profile of buffalo calves. It is concluded that detomidine is a safe sedative and analgesic drug which can be used in ruminants for restraining and minor surgical interventions.

Key Words: Detomidine; Blood; Electrolyte; Buffalo

INTRODUCTION

The latest advancements in the field of sedatives and analgesics have solved the problems of veterinary surgeons involved in the treatment of various disorders requiring minor and major surgical interventions. Detomidine {Domosedan, 4-(2,3-dimethyl benzyle) imidazole hydrochloride} is a new synthetic alpha-2 adrenoceptor agonist with sedative and analgesic properties. Initially, detomidine was developed for use as a sedative and analgesic in horses (Alitalo & Vainio, 1982). However, it has also been used in laboratory animals (Hall & Clarke, 1991) but no work has been done on the use of detomidine in buffaloes. Therefore, the present study was carried out on buffaloes and the effects of detomidine were studied on blood chemistry, haemogram and electrolyte profiles to evaluate its safety in this species.

MATERIALS AND METHODS

Ten buffalo calves, 5-6 months of age were used in this study. The health status was judged to find out any abnormality and were provided normal feed and water as per routine. A week prior to study, the animals were treated for ecto and endo parasites. A special emphasis was given to assess the normal functioning of liver and kidney.

Detomidine MPV 253 (Detomidine hydrochloride 10 mg mL^{-1}; Farmos Orion Pharmaceutical company Turku, Finland) was administered to the animals @ 50 μg kg^{-1} body weight intramuscularly.

The blood and urine samples were collected at different intervals, 1st before the injection, 2nd at 30 min, 3rd at 60 min and 4th at 90 min post injection. For hemogram, about 6 mL fresh blood was collected directly from jugular vein in test tubes containing E.D.T.A (Ethylene diamine Tetra Acetic Acid) as an anticoagulant. The urine samples were collected in urine collection bags. The samples collected were evaluated for different parameters using kits prepared by Randoux Laboratory U. K. under standard conditions.

RESULTS

Effect of detomdine on blood chemistry:

Liver function tests (LFTs). LFTs revealed an increase in the concentration of all hepatic enzymes tested at different intervals after the injection of detomidine. However, the value of SGOT showed slight increase and it remained close to the normal value. The serum alkaline phosphatase showed significant difference within the samples collected at different intervals (Table I).

Renal function tests (RFTs). The samples collected at different interval showed increase in the concentration of urea and creatinine, but it remained within the normal range. The concentration of uric acid remained fluctuating close to the normal value in all the experimental animals (Table I).

Serum cortisol. A marked increase in serum cortisol level was observed in blood samples collected at different intervals. The serum level increased significantly at 30 min and showed gradual decline at 60 and at 90 min onward, although it was still higher than the normal (Table I).

Effect of detomidine on haemogram:

Haemoglobin. There was a decrease in haemoglobin between 30 and 60 min post injection of detomidine in all the experimental animals followed by gradual increase and became normal by 90 min post injection. However, the fluctuation was within the normal range. (Table II)

Total leukocytic count (TLC). A sharp decline in TLC was noticed in all the animals by 30 min post injection

Table I. Effect of detomidine on blood chemistry of experimental buffalo calves (n= 10, mean values)

Time (minutes)		*Serum cortisol (*μg/dl*)	*SGPT (*u/L*)	SGOT (*u/L*)	*SAP (*u/L*)	Bilirubin total (*mg/dl*)	Urea (*mg%*)	*Creatinine (*mg/dl*)	Uric Acid (*mg/dl*)
0	Mean	1.27	43.80	149.4	264.90	0.069	23.34	0.789	2.39
	S.D	0.188	3.011	5.910	14.888	5.782	1.639	4.427	5.044
30	Mean	2.37	52.50	146.7	257.70	0.087	22.71	0.84	2.34
	S.D	0.490	3.591	5.229	10.625	6.183	1.519	7.639	8.902
60	Mean	2.08	55.50	144.6	292.50	0.074	23.00	0.91	2.29
	S.D	0.551	3.807	5.929	9.4192	5.190	1.747	5.590	0.124
90	Mean	1.78	57.30	149.6	326.80	0.065	23.90	0.94	2.30
	S.D	0.370	4.644	8.707	19.007	4.625	1.896	4.504	0.126
Normal values		1.4-1.6	36-38	140-160	240-280	0.70 (0.5-1.9)	33.75 ± 9.25	0.730-1.5	2.30-2.45

* indicates significant difference ($p<0.05$) in the values at different intervals

Table II. Effect of detomidine on haemogram of experimental buffalo calves (n= 10, mean values)

Time (minutes)		Hb (*gm%,*)	TLC (*/cumm*)	DLC (*/cumm%*)				ESR(*mm/hr*)
				P	L	M	E	
0	Mean	11.57	9360.5	21.5	72.5	3.8	2.1	2.1
	S.D	0.880	1299.13	1.5811	1.4337	0.6325	0.3162	0.3162
30	Mean	9.89	7913.3	31.9	67.9	3.0	1.7	2.1
	S.D	0.684	1130.54	14.16	3.7253	0.9428	0.3162	0.3162
60	Mean	9.82	8584.30	34.20	59.80	4.2	2.10	1.90
	S.D	0.899	1065.19	6.0700	6.3561	0.3162	0.3162	0.3162
90	Mean	10.96	8267.30	32.40	61.90	3.1	1.80	2.1
	S.D	1.196	2603.29	5.910	5.8963	0.4216	0.3162	0.3162
Normal Values		12.35±2.45	10513±2292	3999±1579	6035±1159	532±226	382±142	2-3

Table III. Effect of detomidine on electrolyte levels in buffalo calves (n= 10, mean values)

Time (minutes)		Electrolytes			
		Na^+ (mmol/L)	K^+ (mmol/L)	Cl^- (mmol/L)	HCO_3 (mmol/L)
0	Mean	139.8	4.83	102.8	25.1
	S. D	2.440	1.611	3.047	1.370
30	Mean	137.6	4.67	101.3	26.5
	S. D	2.118	1.704	2.584	1.509
60	Mean	135.7	4.01	101.2	27.6
	S. D	2.806	0.672	2.250	2.065
90	Mean	133.6	3.79	101	26.4
	S. D	2.796	0.664	3.431	1.494
Normal Values		139 ± 4	4.3±0.7	103.5±7	25±5

Table IV. Urinalysis of detomidine administered experimental buffalo calves (n= 10)

Time (minutes)		Sugars	Alb	Blood	pH	Specific Gravity	Micro. Exam.
0	Mean	-	+	-	8.55	1.010	-
	S.D	NA	NA	NA	0.052	0.045	NA
30	Mean	-	±	-	8.55	1.005	+++
	S.D	NA	NA	NA	0.052	0.023	NA
60	Mean	-	±	-	8.55	1.005	+++
	S.D	NA	NA	NA	0.052	0.023	NA
90	Mean	-	±	-	8.55	1.005	+++
	S.D	NA	NA	NA	0.052	0.023	NA

NA = Not Applicable; * indicates significant difference ($p<0.05$) in the values at different intervals

followed by an increase at 60 min and 2nd decline was noticed at 90 min. The changes were within normal range (Table II).

Differential leukocytic count (DLC). The study revealed a marked increase in polymorph leukocyte count at 30 min and gradual increase upto 60 min followed by gradual decrease onward. However, a significant decline in number was noticed in lymphocytes upto 60 min followed by gradual increase. The eosinophils and monocytes showed slight change in number during the experiment (Table II).

Erythrocyte sedimentation rate (ESR). No change in ESR was noticed in the blood samples collected at different intervals during the experiment (Table II).

Effect on electrolyte profile. A negligible decline in serum sodium (Na^+), potassium (K^+) and chloride (Cl^-) levels was noticed in the blood samples assayed post-detomidine injection. However, there was a slight increase in the serum carbonates (HCO_3^-) after detomidine injection (Table III).

Urinalysis. The Urinalysis showed no evidence of sugar and blood in all the samples collected at different intervals. Likewise, there was no change in the pH of urine after detomidine injection. However, albumen and specific gravity was decreased. Microscopic examination revealed presence of amorphous crystals in all the urine samples (Table IV)

DISCUSSION

An increase in the serum cortisol level in all the buffalo calves after the injection of detomidine may be due to reaction to the effect of detomidine. Similar results have also been reported previously (Mudge, 1970; Adams, 1982). Liver function tests revealed increase in the value of SGPT and SAP. However, the increase in SGPT was within the normal range.

Whereas, increase in SAP values crossed the normal range. On the other hand there was slight variation in the concentration of SGOT. The increase in SAP might be due to the deficiency in calcium level in the blood stream. The deficiency in calcium level occurs due to excessive ionary excretion of calcium during detomidine sedation. This view has also been presented by Gasthuys *et al.* (1988). Bilirubin (total) level also increased in experimental animals at 30 min post detomidine injection, which gradually declined to the normal level at 30 min. This slight increase indicates some transitory suppressive effect on liver function (Szeligowski *et al*., 1986). Similar to the findings of Innes and Nickerson (1970), the increase in urea and creatinine serum levels were also found during the studies. But these values remained within the normal range. This finding may be attributed to the transitory renal depression. (Gasthuys *et al*., 1986; Trim & Hanson, 1986). Similar findings have also been reported in the past by Alexander (1982). The haematological study of the experimental animals revealed decline in haemoglobin and total leukocytic count. The decline in haemoglobin may be due to temporary suppressive effect on liver function. Detomidine seems to have suppressive effect on immune system of the body, which could be due to the result of increase in cortisol level after detomidine injection (Wood *et al*., 1992).

The serum sodium concentration decreased in all the experimental animals, which might be on account of diuresis caused by the detomidine which led to the excretion of sodium ion (Short *et al*., 1986). The decrease in serum potassium level was possibly due to either excretion through urine or transfer of potassium ions into the cells on account of diuretic effect, hyperglycemia and increased production of cortisol. This is also in agreement with the findings of Feldberg and Symond (1980). The decrease in chloride ions might be due to inadequate removal of carbon dioxide from the blood by the lungs, which resulted into the accumulation of ionzed carbonic acid in the blood. The increase in the bicarbonate ions as evident in this study caused a reciprocal fall in serum chloride level. The chloride ions are also excreted into the urine. (Johnson *et al*., 1978).

Urinalysis did not provide any clue about the presence of sugar in the urine samples. This finding is in agreement with the results of Matthews *et al.* (1986). A marked decrease in the albumen concentration was found in the urine samples. It might have happened due to excessive diuretic effect of alpha-2 agonist drug (Short *et al*., 1986). Similar to the findings of Greene *et al.* (1986) decrease in specific gravity was also observed in all the samples. This might be due to transitory suppressive effect of detomidine on kidneys. Furthermore, alpha-2 adrenergic drug renders kidneys incapable of concentrating the urine.

The results of this study indicated that detomidine is safe drug of choice as it does not cause any significant change in blood chemistry and electrolyte profile. It is concluded that detomidine may be used as sedative and analgesic for restraining and minor surgical interventions in buffalo calves.

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