Indian Journal of Animal Sciences **80** (5): 410–13, May 2010

Haemato-biochemical response to buprenorphine or xylazine along with lignocaine for epidural analgesia in buffalo calves

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Received: 19 March 2009; Accepted: 23 November 2009

ABSTRACT

The study was conducted in 15 healthy male buffalo calves to assess the safety of intercoccygeal epidural buprenorphine and xylazine in combination with lignocaine by estimating various haemato-biochemical parameters. Epidural administration of lignocaine alone or along with buprenorphine caused nonsignificant changes in various haematological parameters whereas lignocaine with xylazine resulted in significant decrease in haemoglobin, packed-cell volume, total leucocyte count, total erythrocyte count, lymphocytes and significant increase in neutrophil count in buffaloes. Serum glucose, urea nitrogen, creatinine, amino alaninetransferase and amino aspartate transferase increased significantly in animals of group C (lignocaine + xylazine) whereas a nonsignificant decrease in serum total protein was observed, however, in animals of group A (lignocaine alone) and group B (lignocaine + buprenorphine) increase was non-significant. The increase in various haematological and biochemical parameters returned to base values within 24 h. Thus, epidural buprenorphine and xylazine along with local anaesthetic can be safely used in buffaloes as it caused transient haematobiochemical alterations, which attained normal physiological values within few hours.

Key words: Buffaloes, Buprenorphine, Epidural, Lignocaine, Xylazine

Lignocaine hydrochloride (N-diethylaminoacetyl 2,6-xylidine hydrochloride) was successfully used to produce epidural anaesthesia in buffaloes (Hussain and Kumar 1989) and cattle (Tamara *et al.* 2002). However, repeated injections produce complications like hind limb paralysis, severe ataxia, radial paralysis and prolonged recumbency. Alpha$_2$ agonist used as epidural analgesia produced significantly longer duration of analgesia than that to lignocaine alone as reported in cows (Jean *et al*. 1990). There is paucity of literature regarding the epidural use of narcotic analgesic alone and in combination with other analgesic drugs. The present study was therefore, undertaken to study the effect of lignocaine alone and in combination with buprenorphine and xylazine in buffalo calves.

MATERIALS AND METHODS

Non-descript, healthy male buffalo calves (15) ranging from 6 to 8 months of age and weighing from 55 to 75 kg, were stall fed, provided clean drinking water and kept under uniform managemental conditions throughout the period of observation. Each animal was kept off feed for 24 h and water was withheld for 12 h prior to start of experiment. The animals were restrained in standing position and the first intercoccygeal space was prepared for aseptic injection of drug.

The animals were divided in 3 treatment groups A, B and C comprising 5 animals in each group. In group A, lignocaine @ 2.2 mg/kg, group B lignocaine @ 2.2 mg/kg + buprenorphine @ 20 mg/kg body weight, and in group C lignocaine @ 2.2 mg/kg + xylazine @ 0.05 mg/kg were injected epidurally. The total volume of the drug injected was made 10 ml in all the treatment groups after reconstituting them with distilled water for epidural injection.

Haematological parameters: Venous blood (5 ml) from external jugular vein was collected before and at 15, 30, 60, 90, 120, 240 min and 24 h interval after administration of drug in clean dry glass vials containing 2 mg of ethylene diaminine tetra acetic acid. The various haematological parameters included estimation of haemoglobin, packed cell volume, total erythrocyte count and differential count (Jain 1986).

Biochemical parameters: Venous blood (10 ml) was collected in dry test tube before and at 30, 60, 90, 120, 240

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min and 24 h interval following administration of drugs. Serum was separated for estimation of serum glucose, total protein, serum urea nitrogen, creatinine, alanine aminotransferase and aspartate aminotransferase levels using computerized semi-automated analyzer.

The data obtained were analysed as per Snedecor and Cochran (1994).

RESULT AND DISCUSSION

Haematological parameters

A significant (P<0.01) decrease in haemoglobin concentration (7.32±0.32 as compared to base value (9.06±0.21 g %) was recorded at 60 min interval in animals of group C (lignocaine +xylazine) whereas the animals of group A (lignocaine alone) and group B (lignocaine + buprenorphine) recorded a nonsignificant decrease in values throughout the observation period, which might have resulted from pooling of circulating blood cells in the spleen secondary to decreased sympathetic activity (Table 1), which was also observed in buffaloes (Peshin and Kumar 1983, Sharda *et al*. 2008). Similarly significant (P<0.01) decrease in packed cell volume at 60 min interval was seen in animals of group C (lignocaine + xylazine). The decrease in packed-cell volume and total erythrocyte count during the period of anaesthesia or sedation might also be due to shifting of blood from extravascular compartment to intravascular compartment (Wagner *et al.* 1991) to maintain normal cardiac output in animals. However, the decrease in packed-cell volume was marginal in group A and group B animals, which could be attributed to lesser sedation observed in these groups due to lesser absorption of buprenorphine into circulation from subarachnoid space because of its high lipophilic nature as also recorded by Pathak *et al.* (2005).

Leucocytopaenia (Table 1) observed with minimum decrease at 60 min interval in group C (lignocaine + xylazine) animals could be due to pooling of circulating blood cells in spleen or other reservoirs secondary to decreased sympathetic activity (Jean *et al.* 1990). A significant (P<0.01) rise in neutrophil and simultaneous decrease in lymphocyte following administration of lignocaine along with xylazine possibly could be due to adrenocortical stimulation and subsequent effect of glucocorticoids (Grubb *et al*. 2002) on circulating neutrophils. A transient and fluctuating count of monocyte, eosinophil was recorded in all the 3 treatment groups, which varied nonsignificantly.

Biochemical parameters

A significant (P<0.01) increase in serum glucose (Table 2) concentration from 30 to 120 min interval was seen following administration of various drug combinations epidurally in animals of all the 3 groups. However, the values of glucose remained significantly (P<0.01) higher up to 240 min interval

Table 1. Haematological observations before and after epidural administration of lignocaine alone (group A) and in combination with buprenorphine (group B) and xylazine (group C) in buffalo calves

Parameters	Groups	Time intervals (min)					
		0	30	60	120	240	24 h
Haemoglobin (g %)	A	8.58±0.19	8.48^{b}±0.19	8.40^{b}±0.19	8.18±0.20	8.30^{a}±0.17	8.60±0.17
	B	8.08±0.19	8.18^{b}±0.19	8.10^{b}±0.20	8.00±0.20	8.02^{a}±0.17	8.16±0.17
	C	9.06±0.21	7.38^{a}**±0.20	7.32^{a}**±0.32	8.00**±0.38	8.88^{b}±0.22	9.48±0.47
Packed cell volume (%)	A	28.00±0.71	25.40^{a}±0.75	24.40*^{a}±1.30	28.20^{b}±1.20	28.00^{b}±1.34	27.20±1.02
	B	27.60±1.07	26.80^{a}±1.15	26.80^{b}±1.28	28.20^{b}±1.20	28.00^{b}±1.34	27.20±1.02
	C	28.40±0.60	23.20*^{a}±0.45	22.60**^{a}±0.75	23.60**^{a}±0.75	24.60^{a}±0.76	28.60±2.64
TEC ($\times10^{3}$cu.mm^{-1})	A	7.35±0.37	6.98^{a}±0.41	6.85*^{a}±0.32	6.95^{b}±0.0.49	7.10^{b}±0.34	7.24±0.51
	B	7.44±0.42	7.04^{a}±0.45	6.87^{b}±0.38	6.92^{b}±0.52	7.21^{b}±0.43	7.31±0.56
	C	6.85±0.58	6.45*^{a}±0.44	6.32*^{a}±0.48	6.65^{b}±0.43	6.68^{b}±0.41	6.72±0.44
TLC ($\times10^{6}$cu.mm^{-1})	A	4.98±0.11	4.87±0.12	4.97±0.13	5.20±0.22	5.30±0.19	5.23±0.14
	B	5.20±0.25	5.08±0.23	5.19±0.24	5.68±0.23	5.66±0.23	5.50±0.23
	C	6.77±0.39	6.35±0.34	5.97**±0.30	6.06±0.28	6.28±0.28	7.09±0.37
DLC lymphocyte (%)	A	59.40±0.51	58.80±0.37	58.80±0.37	58.80±0.58	59.20±0.37	58.20±0.37
	B	59.20±0.86	58.60±0.81	58.20±0.58	58.00±0.55	58.00±0.63	58.20±0.49
	C	60.80±0.40	59.80±0.66	57.40**±0.50	58.20*±0.37	58.00**±0.55	58.20±1.24
Neutrophils (%)	A	34.60±0.68	35.20±0.58	35.20±0.37	34.60±0.51	35.60±0.68	35.60±0.51
	B	34.60±0.51	35.60±0.24	35.60±0.24	35.40±0.24	36.40±0.24	35.80±0.37
	C	30.80±0.58	31.60±0.51	33.80**±0.73	33.20*±0.58	33.60**±0.51	33.60**±0.75
Eosinophils (%)	A	2.40±0.24	2.00±0.32	2.40±0.51	2.40±0.24	2.00±0.32	2.60±0.51
	B	2.40±0.40	2.00±0.55	2.20±0.20	2.00±0.32	1.80±0.37	1.20±0.49
	C	3.40±0.24	3.20±0.58	3.60±0.24	3.20±0.20	3.60±0.24	3.40±0.40

Means bearing different superscripts differ significantly at corresponding intervals (P<0.05); *significantly different from the base value within group (P<0.05); **significantly different from the base value within group (P<0.01).

Table 2. Biochemical observations before and after epidural administration of lignocaine alone (group A) and in combination with buprenorphine (group B) and xylazine (group C) in buffalo calves

Parameters	Groups	Time intervals (min)					
		0	30	60	120	240	24 h
Serumglucose (mg/dl)	A	60.24±1.60	66.30**^{b}±1.89	68.74**^{b}±1.74	72.10**^{b}±0.75	66.73^{b}±0.94	58.05±1.88
	B	51.80±3.94	64.00*^{a}±3.92	68.20**^{a}±3.57	59.00^{a}±3.88	53.20^{a}±4.04	51.00±4.08
	C	44.60±2.09	61.80**^{ab}±3.14	78.80**^{b}±4.02	84.40**^{c}±2.11	76.40**^{c}±2.46	50.40±2.25
Serum total protein (g/dl)	A	6.85±0.21	6.78±0.23	6.60±0.25	6.32±0.25	6.30±0.22	6.46±0.23
	B	6.48±0.27	6.48±0.25	6.22±0.38	6.32±0.24	6.52±0.22	6.44±0.21
	C	6.50±0.20	6.93±0.17	6.28±0.13	6.00±0.27	6.17±0.23	6.47±0.19
Serum urea nitrogen	A	20.80±0.74	21.42±0.54	22.07^{b}±0.50	22.30±0.50	20.59±0.51	20.88±0.53
(mg/dl)	B	20.70±0.51	20.41±0.43	18.37**^{a}±0.45	22.64**±0.31	22.50**±0.40	18.90**±0.40
	C	21.04±0.73	23.09*±0.54	23.51*^{b}±0.52	24.04**±0.48	22.08±0.44	22.02±0.43
Serum creatinine	A	1.20±0.12	1.76*^{b}±0.16	1.44±0.16	1.31^{a}±0.13	1.35±0.20	1.29±0.21
(mg/dl)	B	1.90±0.20	1.06^{a}±0.08	1.60±0.11	1.86^{b}±0.17	1.90±0.17	1.90±0.17
	C	1.34±0.15	1.93**^{b}±0.17	2.00**±0.16	1.93**^{b}±0.15	1.70±0.07	1.46±0.13
ALT (U/L)	A	8.73±0.24	9.24^{b}±0.28	9.40±0.20	9.85^{b}±0.24	9.24*^{b}±0.30	9.05^{b}±1.56
	B	7.92±0.33	7.75^{a}±0.35	9.01*±0.36	8.00^{a}±0.45	7.98^{a}±0.32	8.02^{a}±0.24
	C	8.32±0.36	8.42^{ab}±0.38	9.70*±0.34	9.18^{a}±0.33	8.58^{ab}±0.36	8.54^{ab}±0.35
AST (U/L)	A	24.26±1.20	27.08^{a}±1.26	27.23±1.22	28.91±1.24	28.00±1.41	25.37±1.40
	B	26.20±1.60	29.60^{ab}±0.75	36.80**±0.95	40.40**±1.21	31.20*±1.65	27.80±1.36
	C	24.50±0.86	27.66^{b}±0.84	32.00*±1.09	31.18*±1.00	29.85±0.74	25.21±0.83

Means bearing different superscripts differ significantly at corresponding intervals (P<0.05); *significantly different from the base value within group (P<0.05); **significantly different from the base value within group (P<0.01).

in group C (lignocaine +xylazine) animals. Hyperglycaemia might have resulted due to an alpha$_2$ adrenergic inhibition of insulin release by stimulation of alpha$_2$ receptors in the pancreatic ß cells (Angel and Langer 1988) and to an increased glucose production in liver (Tranquilli *et al.* 2007). These findings simulate with the observations reported by Sharda *et al.* (2008) in buffaloes.

The decrease in plasma total protein between 1 to 2 h periods following epidural injection of various drugs in all the 3 treatment groups was nonsignificant. This decrease could be attributed to the increased levels of glucocorticoids, adrenal activity and increased protein turn over resulting in decreased plasma protein and albumin (Hansraj 1997). It is also mentioned that decreased insulin level may modify general metabolism and impair protein synthesis (Schumann 1990), and adrenal steroids also reduce the rate of protein synthesis by antagonizing the effect of insulin (Turner and Bagnara 1976).

A significant (P<0.01) increase in serum urea nitrogen and creatinine between 30 and 120 min post-epidural injection was recorded in animals of group C (lignocaine + xylazine). These observations are in accordance with epidural administration of lignocaine alone and in combination with xylazine in goats (Kinjavadekar 1998) and buffaloes (Singh 1999). An increase serum urea nitrogen and creatinine might be attributed to the temporary inhibitory effect of drug on renal blood flow (Kinjavadekar *et al.* 1999). The increase in the values of the other 2 groups, i.e. A (lignocaine alone) and B (lignocaine + buprenorphine) was not statistically significant.

A significant (P<0.01) increase in the levels of alanine aminotransferase and aspartate aminotransferase was recorded following administration of lignocaine along with xylazine (group C) epidurally in animals. The increase in the values persisted from 1 to 2 h interval and thereafter gradually returned to the base levels by 24 h. It is documented that alpha$_2$ againsts are potent CNS depression agents and thereby some alterations might have taken place in cell membrane permeability which permit these enzymes to leak from the cells with intact membrane (Koichev *et al.* 1988). However, the increases in the values of enzymes in other 2 treatment groups were not statistically significant.

These observations on various haematobiochemical parameters suggested that the alterations recorded at various time intervals following epidural injection of buprenorphine along with xylazine and lignocaine were not of great magnitude. The changes were transient and more or less same in animals of all the groups and returned to base levels with in 24 h. The use of opoids and alpha$_2$ agonist in adjunct to local anaesthetic can be safely used as epidural anaesthesia in bovines.

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