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Haemato-biochemical Response to Lignocaine alone or in Combination with Xylazine for Epidural Analgesia in Cow Calves

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Abstract

The present study was undertaken to evaluate the effect of local analgesic (lignocaine) alone or in combination with alpha-2 adrenergic agonist (xylazine) on haemato-biochemical parameters. The study was conducted on 12 healthy male cow calves, which were divided into two equal groups (group A and group B), and induced into two equal quantity of lignocaine alone (group A) or in combination with xylazine (group B). Haematological and biochemical parameters were measued before and at 15, 30, 60, 90, 120, 240 minutes and 24 hours intervals after administration of drugs. No significant changes were observed in animals of the group A, except the significant increase (P <0.01) in serum glucose concentration from 30 to 120 minutes intervals. In group B, a significant decrease in haemoglobin concentration and packed cell volume was observed after 30 minutes, which persisted up to 120 minutes interval as compared to base value. There was a significant decrease in total leucocytes count at 60 minutes interval and a significant increase in neutrophils percent and simultaneous decrease in lymphocytes percent between 60 to 120 minutes intervals. In addition, a significant (P <0.01) increase in serum glucose concentration from 30 to 240 minutes intervals was observed. The decrease in serum total proteins (P <0.05), and the increase in blood urea nitrogen and creatinine (P <0.05) levels, and in ALT and AST (P <0.01) activities were significant between 60 to 120 minutes intervals. The values were returned to normalcy by 24 hours in both groups. Thus, epidural xylazine along with local anaesthetic can be safely used in cow calves as it caused transient haemato-biochemical alterations.

Keywords: Cow calves; Epidural; Lignocaine; Xylazine

Introduction

The cattle occupy a unique place in the agricultural economy of our country. Indian cattle have an immense potential for food and power. India accounts for world's 56% of cattle, which has commonly affected with surgical diseases viz. urolithiasis, ruptured bladder, prolapse of vagina and uterus, dystocia, volvulus, strangulation, fracture, ruminal impaction, etc. Majority of these ailments requires surgical correction and management, which can be accomplished under epidural analgesia.

Lignocaine hydrochloride (N-diethylamino acetyl 2,6-xylidine hydrochloride) was successfully used to produce epidural anaesthesia in cattle (Tamara *et al*., 2002). However, repeated injections produce complications like hind limb paralysis, severe ataxia, radial paralysis and prolonged recumbency. The alpha-2 agonist 2(2,6-dimethylphenyl amino-4H-5,6-dihydro-1,3-thiazine-hydrochloride) as epidural analgesia produces significantly longer duration of analgesia than lignocaine alone as reported in cows (Jean *et al*., 1990). The present study was therefore, undertaken to study the effect of epidural lignocaine alone or in combination with xylazine on some haemato-biochemical parameters in cow calves.

Materials and methods

Twelve clinically healthy non-descript, stall- fed male cow calves, aged 7 to 8 months and weighing 55 to 65 kgs were used in this study. One month before the start of the experiment, all the animals were dewormed with albendazole (Albomar, Glindia Ltd. Mumbai) at 7.5mg /kg body weight orally. Each animal was kept off feed for 24 hours, and water was withheld for 12 hours prior to start of the experiment. The animals were restrained in standing position and the first intercoccygeal space was prepared for aseptic injection of the drugs. The animals were equally divided in 2 treatment groups

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(A and B), comprising six animals in each group. In group A; lignocaine at 2 mg/kg body wt and in group B, lignocaine at 2 mg/kg body wt in combination with xylazine at 0.5 mg/kg body wt was injected epidurally. The total volume of the injected drug in both groupswas kept constant at 7 ml after reconstituting drugs with distilled water for epidural injection. For haematological parameters, 3 ml venous blood was collected from the jugular vein before and at 15, 30, 60, 90, 120, 240 minutes, and 24 hours intervals after administration of drug in clean dry glass vials containing ethylene diaminine tetra acetic acid. The haematological parameters included haemoglobin concentration, packed cell volume (PCV), total erythrocytes count (TEC), total leucocytes count (TLC) and differential leukocytes count (Jain, 1986). For biochemical parameters; 8 ml venous blood was collected in dry tubes before and at 30, 60, 90, 120, 240 minutes and 24 hours intervals following administration of drugs. Serum was separated for estimation of glucose (O-Toluidine method), total proteins (Wooton, 1964), blood urea nitrogen (Harold, 1976), creatinine (Thomas, 1998) levels, and alanine aminotransferase (ALT), and aspartate aminotransferase (AST) activities using commercially available kits (J.M. Technochem, 44-sector B, Defence colony, Ambala Cantt, Haryana). The data obtained were analyzed as per the procedure given by Snedecor and Cochran (1994).

Results

Group A

No significant changes were observed in animals of the group A after administration of lignocaine, except the significant increase (P <0.01) in serum glucose concentration from 30 to 120 minutes intervals.

Group B

A significant decrease in haemoglobin concentration and PCV % was observed after 30 minutes, which persisted up to 120 minutes interval as compared to base value. There was a significant decrease in TLC at 60 minutes interval and a significant increase in neutrophils percent and simultaneous decrease in lymphocytes percent between 60 to 120 minutes intervals. Monocytes and eosinophils percent showed no significant changes at different time intervals. However, the values were compensated and returned towards pre-administration level by 24 hours (Table 1).

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

	Groups	Time intervals					
		0	30 min	60 min	120 min	240 min	24hours
Haemoglobin (g/dl)	A	8.76±0.22	8.51 ±0.18	8.43 ±0.35	8.17±0.23	8.32 ±0.14	8.71±0.21
	B	8.48±0.28	7.34±0.32**	7.28±0.32**	7.84±0.38*	8.02 ±0.22	8.39±0.34
PCV (%)	A	28.40±0.67	26.38 ±0.75	26.32 ±0.67	26.20 ±0.44	28.00 ±0.34	28.30±0.24
	B	28.86±0.54	24.30±0.73*	22.60±0.73**	23.56±0.66**	24.60 ±0.76	28.71±0.75
TEC (×10 ^{3} /mm^3)	A	7.54±0.28	6.72 ±0.41	6.85 ±0.32	6.95 ±0.49	7.28±0.34	7.51±0.43
	B	7.41±0.53	6.38 ±0.34*	6.32 ±0.47*	6.65±0.43	6.68±0.52	7.40±0.42
TLC (×10 ^{6} /mm^3)	A	5.73±0.24	4.85±0.20	4.73±0.22	5.10±0.12	5.22±0.19	5.67±0.20
	B	6.77±0.40	6.35±0.24	5.67±0.30*	6.06±0.30	6.28±0.22	7.69±0.41
Lymphocytes (%)	A	60.10±0.39	58.80±0.32	58.74±0.37	58.74±0.58	59.20±0.37	59.70±0.36
	B	60.30±0.53	59.80±0.66	57.40±0.45**	58.20±0.42*	58.60±0.41*	59.82±0.62
Neutrophils (%)	A	34.72±0.55	35.30±0.67	35.30 ±0.52	34.20±0.51	34.40±0.68	34.60±0.52
	B	32.70±0.58	33.60±0.51	35.80±0.66**	35.20±0.62*	33.60 ±0.51	32.60 ±0.67
Eosinophils (%)	A	2.50±0.26	2.10±0.32	2.40±0.51	2.40±0.24	2.00±0.32	2.30±0.45
	B	3.40±0.43	3.20±0.58	3.60±0.24	3.20±0.20	3.60±0.24	3.40±0.28
Monocytes (%)	A	5.78±0.21	5.14±0.29	4.64±0.30	4.64±0.34	5.18±0.36	5.50±0.36
	B	5.74±0.32	5.16±0.20	4.94±0.29	4.50±0.25	4.68±0.20	5.26±0.13

Data expressed as mean ± SD, mean bearing different superscripts differ significantly at corresponding intervals; **significantly different from the base value within group (P<0.01); *significantly different from the base value within group (P<0.05)

A significant (P <0.01) increase in serum glucose concentration from 30 to 120 minutes intervals was observed. However, the values of glucose remained significantly (P<0.01) higher up to 240 minutes interval. The decrease in serum total proteins (P<0.01), and the increase in blood urea nitrogen and creatinine (P <0.01) levels, and in ALT and AST (P <0.01) activities were significant between 60 to 120 minutes intervals. The values returned to normalcy by 24 hours in both groups (Table 2).

Table 2. Serum biochemical constituents before and after epidural administration of lignocaine alone (group A) or in combination with xylazine (group B) in cow calves.

	Groups	Time intervals					
		0	30 min	60 min	120 min	240 min	24hours
Glucose (mg/dl)	A	61.38±0.40	67.30±0.74**	68.54±0.83**	72.30±0.75**	66.73±0.94	60.18±0.86
	B	60.52±1.16	65.40±1.18**	77.65±1.02**	83.46±1.12**	76.40±1.37**	60.40±1.28
Total proteins (g/dl)	A	6.58±0.27	6.78±0.23	6.60±0.25	6.32±0.25	6.36±0.22	6.47±0.20
	B	6.70±0.25	6.63±0.22	6.10±0.18*	6.00±0.23*	6.17±0.27	6.64±0.18
Blood urea nitrogen (mg/dl)	A	21.50±0.62	21.80±0.54	22.10±0.52	22.40±0.56	22.10±0.63	21.48±0.58
	B	21.44±0.67	23.12±0.66*	24.14±0.58*	24.23±0.54*	22.94±0.63*	21.42±0.63
Creatinine (mg/dl)	A	1.30±0.20	1.45 ±0.22	1.56±0.22	1.63 ±0.20	1.46±0.20	1.34±0.23
	B	1.38±0.21	1.88 ±0.23*	2.06±0.20**	2.14±0.18**	1.66±0.15	1.29±0.18
ALT (U/L)	A	9.05±0.26	9.24 ±0.28	9.38 ±0.22	9.52 ±0.24	9.41 ±0.26	9.12 ±0.32
	B	9.16±0.27	9.37 ±0.22	9.64±0.28*	9.81±0.30*	9.58 ±0.28	9.20 ±0.24
AST (U/L)	A	23.28±1.13	25.10 ±1.18	26.34±1.16	27.89±1.16	27.30±1.33	23.12±1.26
	B	23.20±1.11	25.22 ±1.34	28.18±1.26*	30.24±1.18*	28.40±1.27*	24.06±1.31

Data expressed as mean ± SD, mean bearing different superscripts differ significantly at corresponding intervals; **significantly different from the base value within group (P<0.01); *significantly different from the base value within group (P<0.05)

Discussion

The decrease in haemoglobin concentration, PCV % and TEC during the period of anaesthesia or sedation (Table 1) might be due to shifting of fluids from extravascular compartment to intravascular compartment in order to maintain normal cardiac output (Jean *et al*., 1990, Wagner *et al*., 1991)), and might be also due to pooling of circulating blood cells in the spleen secondary to decreased sympathetic activity (Sharda *et al*., 2008). Similar findings have also been reported after epidural administration of xylazine in cattle (Jean *et al*., 1990), horse (Skarda and Muir, 1994) and after epidural administration of alpha-2 adrenergic agonist in buffalo calves (Pratap *et al*., 2001).

Leucocytopaenia could be attributed to pooling of circulating blood cells in spleen or other reservoirs secondary to decreased sympathetic activity (Jean *et al*., 1990). Neutrophilia and lymhopaenia possibly could be due to adrenocortical stimulation and subsequent effect of glucocorticoids on circulating neutrophils (Grubb *et al*., 2002). Similar observations were also recorded after administration of xylazine, ketamine and medetomidine in goats (Hugar, 1993).

Hyperglycaemia, following the epidural administration of α-2 agonist (Table 2) has also been reported by Kumar and Singh (1976) in cattle and Custer *et al*. (1977) in camel. Alpha -2 agonist induced hyperglycaemia in cow had been reported to arise by the combination of increased hepatic glucose production and reduced plasma insulin concentration (Symonds and Mallinson, 1978). The alpha-2 agonist induced hyperglycemia and hypoinsulinaemia might be mediated by α-2 adrenergic receptor possibly in beta-cells of pancreatic islets, which inhibit the release of insulin (Hsu and Hummel, 1981). The present findings corroborate with the observations of Tiwari *et al*. (1999). The decrease in total proteins might be due to the increased levels of glucocorticoids, increased adrenal activity and increased protein turnover resulting in decreased plasma proteins. Decrease in insulin levels might also modify the general metabolism and impair protein synthesis (Schumann, 1990). Adrenal steroids as well reduce the rate of protein synthesis by antagonizing the effect of insulin (Turner

and Bagnara, 1976). Kumar and Thurmon (1979) also reported a reduction in total proteins after xylazine administration in goats. An increase in blood urea nitrogen and creatinine levels might be attributed to the temporary inhibitory effect of drug on the renal blood flow (Kinjavadekar *et al*., 1999). Alpha-2 agonists are potent CNS depressants 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). Similar observations were recorded after detomidine administration in cattle (Samy *et al*., 1984).

Conclusion

The present study suggested that the alterations recorded at various time intervals following epidural injection of lignocaine alone or with xylazine were not of great magnitude. The changes were transient and more or less same in animals of both groups and returned to base levels within 24 hours. The use of local anaesthetic alone or in combination with alpha-2 agonist can be safely used as epidural anaesthesia in bovines.

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