Comparative efficacy of lignocaine alone and in combination with Ketamine as epidural anaesthesia in cow calves

B.A. Moulvi, J.D Parrah, M. O. Kalim, H. Athar*, M. Singh and M. A. Baba

Division of Veterinary Surgery and Radiology
Faculty of Veterinary Sciences and A.H., SKUAST - K, Shuhama, Srinagar - 190006, J & K, India.
* Corresponding author email : hakimathar@gmail.com

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Abstract

The present study was conducted to evaluate the clinico-physiological effects of epidural anaesthesia using lignocaine alone and in combination with ketamine in cow calves. Eight clinically healthy non-descript, stall- fed male cow calves aged 7 to 8 months and weighing 55 to 65 kg were used in the study. Animals were divided in two groups of four animals each. In (group A) lignocaine @ 0.5mg/kg body wt. and in (group B) lignocaine @ 0.5mg/kg body wt with ketamine @ 2 mg/kg body wt. was administered at first inter coccygeal epidural space. Clinical observations such as, onset, depth of analgesia, area of desensitization, motor incoordination, salivation, heart-rate, respiration rate and rectal temperature (^{O}F) were recorded before and at 5, 10, 20, 30, 45, 60, 90, 120, 150,180 and 240 minutes after injection of drug(s). Ruminal movements were recorded at every 30 minutes after the injection of drug(s) upto complete recovery and 24 hours after the injection. The onset of analgesia in group B was significantly shorter as compared to group A. Group B animals induced deeper analgesia as compared to group A. In group A animals decrease in heart rate was recorded whereas in group B animals heart rate was increased. In group A, decrease in RR was observed.

Key words: Lignocaine, Ketamine, Epidural, Calves.

Introduction

Lignocaine hydrochloride is an amide-linked local anaesthetic agent being used as 2% solution to produce good surgical analgesia (1). Ketamine hydrochloride is a congener of phencyclidine and chemically designated as (2-{0-chlorophenyl}-2-methylaminocyclohexanone). The commercial product is a 50:50 racemic mixture (2). The positive isomer is more potent than negative isomer for analgesic properties (3). The analgesic properties of ketamine may be mediated via blockade of high affinity monoaminergic uptake sites and inhibition of reuptake of neurotransmitters (4).

The present study was conducted to evaluate the clinico-physiological effects of epidural anaesthesia using lignocaine alone and in combination with ketamine in cow calves.

Materials and Methods

Eight clinically healthy non-descript, stall- fed male cow calves aged 7 to 8 months and weighing 55 to 65 kg were used in the study. Each animal was kept off feed for 24 hrs and water was withheld for 12 hrs prior to start of experiment. After routine preparations, the animals were divided in two groups of 4 each. In (group A) lignocaine @ 0.5mg/kg body wt. and in (group B) lignocaine @ 0.5mg/kg body wt with ketamine @ 2 mg/kg body wt. was administered at first inter coccygeal epidural space. The volume of the drug injected was kept constant i.e. 6 ml in all the groups after reconstituting with distilled water.

Clinical observations recorded included onset and depth of analgesia, area of desensitization, motor incoordination and salivation before and at 5, 10, 20, 30, 45, 60, 90, 120, 150, 180 and 240 minutes after injection. After epidural injection of drug(s), response to pin-prick was recorded at every 15 second interval at thoracic, abdominal and inguinal region till the loss of sensation. Depth of analgesia and area of desensitization were recorded by observing response to pinpricks at a particular region and were graded on a 0 to 3 score scale viz. (0 score- no analgesia; 1 score-mild analgesia; 2 score - moderate analgesia and 3 score- complete analgesia).

The motor incoordination was graded on a 0 to 3 score scale viz (0 score - no incoordination; 1 to 2 score - animal standing and able to walk with little incoordination; 2 to 3 score - animal standing but frequent swaying of body and could walk with extreme incoordination standing). Heart rate, respiratory rate and rectal temperature (^{O}F) were recorded before and at 5, 10, 20, 30, 45, 60, 90, 120, 150,180 and 240 minutes

Table-1. Score of analgesia of Tail, Perineum, Flank, Inguinal, Hind limb, Thorax and Ventral abdomen after different treatments at various time intervals in different groups.

Parameters	Groups	Time Intervals (min)											
		0	5	10	20	30	45	60	90	120	150	180	240
Tail	A	0.00±0.00	0.60 bc±0.28	1.25 ab±0.20	1.40 ab±0.20	1.60 ab±0.60	2.00 ab±0.60	1.50 ab±0.60	1.10 ab±0.40	0.60 a±0.30	0.25 b±0.30	0.15 ±0.28	0.10 ±0.22
	B	0.00±0.00	2.10a±0.28	2.20b±0.20	2.50ab±0.20	2.80ab±0.20	3.00ab±0.20	3.00ab±0.20	2.30 ab±0.40	1.80ab±0.40	1.20 b±0.23	0.25a±0.24	0.20±0.16
Perineum	A	0.00±0.00	0.70±0.16	1.30±0.23	1.30 b±0.20	1.45 b±0.20	2.10ab±0.24	1.40 ab±0.67	1.25 b±0.40	0.80 b±0.30	0.30 b±0.30	0.10±0.23	0.00±0.00
	B	0.00±0.00	2.00±0.22	2.10 b±0.36	2.40 b±0.36	2.70 b±0.20	3.00 ab±0.26	3.00 ab±0.26	2.20 ab±0.26	1.60 b±0.40	1.30 b±0.28	0.45 b±0.32	0.10±0.30
Flank	A	0.00±0.00	0.40±0.10	0.80 b±0.22	1.00 b±0.16	1.40 ab ±0.30	1.85 ab±0.21	1.40 ab±0.21	1.22 ab±0.30	0.50 b±0.22	0.20±0.14	0.20±0.21	0.00±0.00
	B	0.00±0.00	1.30±0.22	1.80±0.20	2.20 b±0.20	2.30 b±0.32	2.50 b±0.20	2.25 ab±0.25	2.20 ab±0.40	1.40 ab±0.40	1.20 b±0.44	0.40 b±0.30	0.23±0.27
Inguinal	A	0.00±0.00	0.30±0.14	0.50±0.20	1.00±0.50 b	1.25±0.50 b	1.70±0.50 b	1.50±0.40	1.20±0.40	0.70±0.30	0.25±0.30	0.25±0.20	0.10±0.12
	B	0.00±0.00	1.25±0.14	1.40±0.40	1.90 b±0.26	2.35 b±0.54	2.80 b±0.40	1.90 ab±0.20	1.80 ab±0.40	1.45 b±0.30	1.10 b±0.24	0.30±0.22	0.20±0.22
Hind Limb	A	0.00±0.00	0.40±0.17	0.55±0.08	0.70±0.16	1.00±0.24	1.50±0.16	1.00±0.40	1.00±0.30	0.60±0.54	0.30±0.44	0.20±0.35	0.20±0.32
	B	0.00±0.00	1.10±0.12	1.30±0.20	1.50±0.30	1.80ab±0.30	2.00ab±0.20	1.50 b±0.20	1.50 b±0.40	1.25±0.30	1.20±0.20	0.30±0.45	0.20±0.31
Thorax	A	0.00±0.00	0.20±0.32	0.30±0.08	0.50±0.19	0.80±0.44	1.00±0.24	1.00±0.40	0.70±0.30	0.60±0.54	0.30±0.44	0.20±0.31	0.00±0.00
	B	0.00±0.00	0.40±0.10	0.70±0.20	1.10±0.30	1.30ab±0.30	1.30ab±0.20	1.40 a±0.20	1.20 b±0.40	1.15±0.30	0.60±0.20	0.30±0.22	0.12±0.26
Ventral Abdomen	A	0.00±0.00	0.30±0.12	0.30±0.17	0.60±0.11	0.90±0.32	1.10±0.22	1.00±0.40	0.70±0.30	0.60±0.54	0.30±0.40	0.20±0.14	0.00±0.00
	B	0.00±0.00	0.50±0.10	0.60±0.20	1.10±0.30	1.20±0.30	1.40a±0.24	1.45 b±0.20	1.25 b±0.40	1.15±0.30	0.50±0.20	0.30±0.22	0.10±0.22

Means bearing different superscripts differ significantly at corresponding intervals

Table-2. Effect on Heart Rate (Beats/ minute), Respiration rate (per min) and Rectal temperature (° F) in different groups at various time intervals

Parameters	Groups	Time Intervals (min)											
		0	5	10	20	30	45	60	90	120	150	180	240
Heart Rate	A	49.80±1.15	49.65±1.02	49.62±0.92	48.15*±1.01	47.40*±1.11	47.20*±1.46	46.25*±1.52	48.60±1.32	48.95±1.39	49.10±1.28	49.24±1.36	49.71±1.01
(Beats/min)	B	49.40±1.02	52.40±1.02	56.60*±0.97	57.80*±0.96	60.40*±0.81	58.80*±0.86	56.00±0.89	55.8±0.86	55.20±1.01	53.80±1.19	51.00±1.18	49.26±1.34
Respiration	A	15.60±0.67	15.54±0.48	15.05±0.37	14.00*±0.31	13.75*±0.39	13.10*±0.50	14.46±0.50	14.80±0.70	14.96±0.70	15.15±0.50	15.32±0.50	15.20±0.31
Rate(/min)	B	16.20±0.79	16.68±0.92	17.22±1.20	18.40±1.39	20.32*±1.44	21.74*±1.79	21.85*±1.87	18.28±1.77	17.72±1.63	17.51±1.49	16.75±0.81	16.38±1.36
Rectal Temp.	A	100.68±0.25	100.44±0.27	100.44±0.27	100.00±0.28	99.80±0.28	99.52±0.27	99.00*±0.23	89.46*±0.15	89.20*±0.47	89.06*±0.20	100.12±0.14	100.26±0.28
(°F)	B	99.88±0.35	99.84±0.40	99.60±0.38	99.16±0.36	98.96±0.37	98.88±0.36	98.18*±0.36	97.96*±0.35	97.20*±0.36	97.46*±0.35	97.32*±0.37	99.80±0.30

Means bearing different superscripts differ significantly at corresponding intervals

after injection of drug(s). Ruminal movements were recorded at every 30 minutes from paralumbar fossa after the injection of drug(s) upto complete recovery and 24 hours after the injection. Onset, persistency and cessation of salivation were also recorded.

The mean and standard error of recorded values were calculated. Data were analyzed by Completely Randomized Design (CRD) as described by (5).

Results and Discussion

The onset of analgesia in group B (5.65±1.86 min) was significantly ($P<0.01$) shorter as compared to that of group A (10.73±2.82 min). Lignocaine along with ketamine (group B) induced deeper analgesia as compared to lignocaine alone (group A).

Depth of analgesia and area of desensitization at tail, perineum and flank in group A animals was mild to moderate between 5 to 45 min which might be due to action of local anaesthetic drugs on spinal nerves that are blocked distal to the dural sheaths after leaving the intervertebral foramina, producing a multiple paravertebral block as reported by (6) in buffalo calves. Group B animals showed complete analgesia of tail, perineum, inguinal and flank region between 10 to 60 min and mild to moderate analgesia of thorax, ventral abdomen and digits which might be due to the fact that ketamine is a potent non-competitive antagonist of NMDA receptors, which are involved in the transmission and modulation of nociceptive information at the spinal cord level (7). Ataxia and motor in coordination was maximum (1 to 2 score scales: animal standing and able to walk with little incoordination) at 10 min to 30 min of post injection in group A animals which could be correlated with the proposed local anaesthetic action on spinal nerve root (8), while in group B motor incoordination was maximum (2to 3 score scales: animal standing but frequent swaying of body and could walk with extreme incoordination) at 10 min to 60 min of post injection. The motor incoordination seen after epidural administration of ketamine in the present study might be due to motor blockade by ketamine. Similar results were reported by (9), in goats, where they recorded moderate to severe hind quarter weakness. Comparison among both groups showed that lignocaine alongwith ketamine induced deeper analgesia in comparison to lignocaine alone.

None of the animals of group A (lignocaine alone) showed salivation during entire period of observation. Animals of group B (lignocaine with ketamine) showed very mild salivation between 10 to 20 min which became mild between 30 to 45 minutes. However, salivation was completely absent at the end of observation.

In group A animals significant ($P<0.05$) decrease in heart rate was recorded between 20 to 60 min interval whereas in group B animals heart rate was significantly ($P<0.05$) increased between 10 to 45 min interval. However, the values returned to near normalcy by 150 minutes. Increase in heart rate might be because ketamine produces its sympathomimetic action primarily by direct stimulation of CNS structures (3). In animals of group A, a significant decrease ($P<0.05$) in RR was observed between 20 to 45 min. which returned to near pre-administration level at the end of observation. Animals of group B, showed a slight increase in RR up to 10 min interval, which became significant ($P<0.05$) between 30 to 60 min interval. Then it decreased gradually and returned to near base value at 180 min interval. The increase in RR might be due to the stimulatory action of ketamine on the respiratory center. (10) reported that tachypnoea occurs due to a residual effect of ketamine, as ketamine activates certain subcortical areas of the CNS. In animals of both the groups a non significant decrease in RT was observed upto 45 min which became significant ($P<0.05$) between 60 to 150 min in group A and 60 to 180 min in group B. This might be due to the reduced basal metabolic rate, muscle activities and depression of thermoregulatory centre. Ruminal movements showed a non significant decrease between 30 to 60 min in both the groups. The values returned to near preadministration level by 24 hrs.

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