

CLINICO-PHYSIOLOGICAL RESPONSE OF XYLAZINE, KETAMINE ALONE AND IN COMBINATION FOR LUMBAR EPIDURAL ANALGESIA IN BUFFALO CALVES

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ABSTRACT

The present study was conducted on five clinically healthy non-descript, male buffalo calves aging 6 to 8 months to evaluate the efficacy of xylazine, ketamine alone and in combination with xylazine and ketamine for lumbar epidural analgesia. The calves were randomly divided into three groups viz- Group A xylazine alone, Group ketamine B alone and in Group C xylazine and ketamine. The onset of analgesia was significantly higher in Group C (3.92±0.16 minutes) as compared to Group B (6.20±0.59 minutes) and Group A (12.64±0.41 minutes). Xylazine alone and in combination with ketamine induced very mild to mild analgesia between 10 to 20 minutes and moderate analgesia between 30 to 60 minutes of thorax and flank while very mild to mild analgesia from 20 minutes to the end of observation in inguinal, perineum, hind limbs and tail region.

Duration of analgesia was also significantly higher in Group C animals (144.80±2.26 minutes) as compared to Group A (131.80±3.42 minutes) and Group B (28.60±1.85 minutes). Salivation was observed in all the groups whereas, it was mild to moderate in Group A, moderate to mild in Group B and extreme in Group C animals. The recovery time was the highest in Group C

animals (195±2.83 minutes) followed by Group A (149.60±1.74 minutes) and Group B (39.40±1.42 minutes). The mean respiration rate and heart rate decreased significantly ($P<0.05$) in Group A and C. Whereas respiration rate and heart rate increased significantly ($P<0.05$) in Group B.

Keywords: Lumbar epidural, xylazine, ketamine, buffalo calves

INTRODUCTION

Branson *et al.* (1993) reported that analgesic effect of xylazine is produced through activation of alpha-2 adrenoceptors present in spinal cord. The analgesic properties of ketamine may be mediated via blockade of high affinity monoaminergic uptake sites and inhibition of reuptake of neurotransmitters (Pekoe and Smith, 1982). Reports regarding clinical use of Xylazine, Ketamine alone and its combination for lumbar epidural anaesthesia in buffalo are limited. Therefore this research work was planned to elucidate the clinico-physiological effects of these combinations in buffalo calves.

MATERIALS AND METHODS

All the animals were subjected to the three treatments. In Group A, only Xylazine 0.1 mg/kg body wt, in Group B Ketamine 2.50 mg/kg body wt. and Group C Xylazine 0.1 mg/kg body wt. and Ketamine 2.50 mg/kg body wt. was administered at lumbar epidural space. The volume of the drug injected was 4 ml in all the groups after reconstituting with distilled water.

Clinical observations included recording of onset of analgesia, depth of analgesia, area of desensitization, motor incoordination, sedation and salivation at 5, 10, 15, 20, 30, 45, 60, 75, 90, 105 and 120 minutes after injection. After epidural injection of drug(s), response to pin pricks was recorded at every 15 seconds at thoracic/abdominal region till the loss of sensation. Time from injection to loss of sensation at thoracic/abdominal region was considered as time of onset of analgesia.

Depth of analgesia and area of desensitization was recorded at thorax, flank, inguinal region, hindlimbs, perineum and tail by observing response to pin pricks at a particular region and were graded on a 0 to 3 score scale. i.e Strong reaction to pin pricks (0/no analgesia), weak response to pin pricks (1/ mild analgesia), occasional response to pin pricks (2/ moderate analgesia) and no response to pin pricks (3/ strong/ complete analgesia).

The motor incoordination was graded on a 0 to 4 score scale i.e Walking without staggering (0), Able to stand but walks with little incoordination (1), Able to stand but walks with extreme incoordination (2), Sternal recumbency but animal is able to flex and extend the limbs if disturbed (3) and Sternal recumbency and animal is unable to flex or extend its limbs (4). Heart rate, respiratory rate, and rectal temperature (°F)

were recorded before and at 5, 15, 30, 45, 60, 75, 90, 105, 120, and 180 minutes after injection of drug(s). Ruminal movements were recorded at every 30 minutes from paralumbar-fossa after the injection of drug(s) up to full recovery and 12 h after the injection. Onset, persistency and cessation of salivation was also recorded.

RESULT AND DISCUSSION

In Table 1 the onset of analgesia in Group C (3.92 ± 0.16 minutes) was significantly ($P < 0.01$) shorter as compared to animals of Group A (12.64 ± 0.41 minutes) and Group B (6.20 ± 0.59 minutes). Depth of analgesia and area of desensitization recorded at thorax and flank in Group A and B animals was very mild to mild between 10 to 30 minutes interval and moderate between 60 to 105 minutes interval. Later on, depth of analgesia was reduced and only mild analgesia was recorded up to 120 minutes. In Group C animals, mild to moderate analgesia between 75 to 60 minutes interval was recorded Complete analgesia was observed between 10 to 60 minutes post injection. Thereafter, a mild to very mild analgesia persisted till the end of observation.

Depth of analgesia and area of desensitization in inguinal region in group A was very mild degree between 15 to 20 minutes post injection period. Thereafter, analgesia increased gradually to its peak effect between 60 to 90 minutes. Animals of Group B and C induced very mild to mild analgesia from 5 to 20 minutes interval and moderate analgesia from 60 to 75 minutes interval. Later on, mild analgesia persisted till the end of observation.

In hind limb and perineum, the depth of analgesia and area of desensitization in animals

of Group A and B showed very mild to mild analgesia between 5 to 45 minutes post injection. Thereafter, mild analgesia persisted till the end of observation with its peak effect from 45 to 75 minutes interval. Group C animals showed very mild to moderate analgesia from 5 to 10 minutes interval and complete analgesia was recorded and maintained for 15 to 60 minutes. Thereafter, analgesia was depressed and became moderate to mild at the end of observation. In tail, depth of analgesia in animals of Group A showed very mild analgesia between 20 to 30 minutes post injection. Thereafter, no analgesia was observed till the end of observation. In Group B and C showed very mild to mild analgesia from 10 minutes till the end of observation with its peak effect between 5 to 60 minutes interval.

Comparison among different groups showed that Xylazine alongwith Ketamine (Group C) induced deeper analgesia in comparison to Xylazine and Ketamine alone. Ketamine induced complete analgesia of thorax and mild to moderate analgesia of inguinal, hind limbs, perineum and tail. Xylazine with ketamine induced complete analgesia of thorax and flank and mild to moderate analgesia of inguinal, hind limbs, perineum and tail. Ketamine has been used most extensively in combination with alpha-2 agonists for systemic use because it is not only a good analgesic but also nullify the majority of the side effects of alpha-2 agonists. Therefore, it is used epidurally in combination with alpha-2 agonists for the same reasons. Epidural administration of combination of ketamine and xylazine in goats (Kinjavdekar, 1998) and cattle (Amarpal *et al.*, 1997) was found suitable for surgery involving hind quarters. Epidural administration of xylazine 0.05 mg/kg body weight and ketamine 2.5 mg/kg respectively in ruminants induced coordination and recumbency

within 5 minutes of drugs administration suggesting local analgesic action of xylazine and ketamine combination (Aithal *et al.*, 1997). Onset of analgesia of 1 to 2 minutes after epidural administration of xylazine (0.05 mg/kg body weight) and ketamine (2.5 mg/kg body weight) spinally in clinical cases. The duration of analgesia was sufficient to conduct various surgical procedures. They concluded that this combination produced excellent analgesia of hind quarter, flank, perineum and abdomen and is safe to use (Kinjavdekar *et al.*, 2002).

All the animals of Group A (xylazine) were able to stand during the entire post-injection period. However, few animals showed little to extreme incoordination while walking from 15 minutes to the end of observation. The animals of Group B (Ketamine alone), were able to stand but showed extreme incoordination while walking up to 20 minutes Little incoordination of hind limbs persisted, thereafter upto 60 minutes. The animals of Group C (xylazine and ketamine) were able to stand but showed extreme incoordination initially but attained sternal recumbency between 30 minutes to 60 minutes post-injection. However, animals showed little incoordination from 75 minutes to 180 minutes.

Sedation was absent in Group A and B whereas, it was mild to moderate in Group C throughout the period of observation except between 20 to 30 minutes, where, sign of deep sedation were observed. Comparison among different groups revealed that the combination of xylazine with ketamine (Group C) showed non significant ($P < 0.05$) higher scores for sedation throughout the period of observation in comparison to Group A and B.

Salivation was mild to moderate degree in Group A and Moderate to mild in Group B whereas, it was mild to moderate salivation in Group C.

Table 5. Effect of physiological parameters after lumbar epidural administration of Xylazine, Ketamine alone and their combination in buffalo calves.

Parameters	Groups	Interval (minutes)											
		0	5	15	30	45	60	75	90	105	120	180	
Rectal temperature (°F)	A	99.52±0.43	99.28 ^b ±0.47	98.68 ^b ±0.58	98.88 ^b ±0.31	98.56 ^b ±0.42	98.48 ^b ±0.35	98.44 ^b ±0.29	98.36 ^b ±0.37	98.14 ^b ±0.42	97.94 ^b ±0.35	97.46 ^b ±0.45	
	B	101.10±0.33	101.20±0.34	101.04 ^b ±0.56	101.18 ^b ±0.57	101.36 ^b ±0.62	101.38 ^b ±0.65	101.46 ^b ±0.63	101.22 ^a ±0.57	101.10 ^b ±0.52	101.10 ^b ±0.33	101.02 ^a ±0.47	
	C	101.08±0.49	101.04 ^b ±0.56	100.48 ^b ±0.38	100.52 ^a ±0.40	100.48 ^b ±0.45	100.40 ^a ±0.46	100.34 ^{**} ±0.45	100.14 ^{**ab} ±0.51	100.06 ^{**ab} ±0.48	100.32 ^a ±0.38	100.34 ^a ±0.36	
Heart rate (per min)	A	64.20±1.69	65.60 ^b ±2.01	64.00 ^b ±1.10	55.20 ^{ab} ±2.15	52.40 ^{**b} ±2.04	50.00 ^{**b} ±1.67	46.80 ^{**b} ±2.15	45.60 ^{**b} ±1.33	42.00 ^{**ab} ±1.41	42.00 ^{**ab} ±1.10	47.20 ^{**ab} ±0.49	
	B	60.00±1.26	75.60 ^{**b} ±3.37	82.00 ^{**b} ±2.97	77.60 ^{**b} ±2.71	73.60 ^{**b} ±3.25	66.40 ^b ±2.48	63.60 ^b ±2.23	61.60 ^b ±2.71	61.20 ^{ab} ±3.07	60.80 ^b ±3.26	57.60 ^b ±2.48	
	C	60.00±2.19	56.80 ^b ±2.24	55.60 ^{ab} ±1.94	50.80 ^{ab} ±1.74	48.80 ^{**b} ±1.50	49.60 ^b ±2.79	49.20 ^{**ab} ±3.07	51.60 ^b ±2.99	54.80 ^b ±3.07	55.60 ^b ±2.23	56.00 ^b ±3.52	
Respiratory rate (per min)	A	14.00±1.38	14.80 ^b ±1.36	12.40 ^b ±2.01	11.00 ^b ±2.41	11.60 ^b ±2.25	11.20 ^b ±2.40	11.40 ^b ±2.09	11.20 ^{**b} ±1.56	11.00 ^{**b} ±1.58	10.00 ^{**b} ±1.58	10.60 ^{**b} ±1.40	
	B	18.00±0.89	22.80 ^{**b} ±1.20	24.40 ^{**b} ±1.17	23.20 ^b ±2.24	22.40 ^b ±2.32	21.20 ^b ±1.96	20.20 ^b ±2.28	19.60 ^b ±2.56	18.80 ^b ±2.24	18.80 ^b ±1.62	17.60 ^b ±1.17	
	C	15.00±0.45	14.40 ^b ±0.75	12.60 ^{ab} ±0.40	11.20 ^b ±1.16	11.60 ^b ±0.68	11.20 ^b ±0.80	12.40 ^b ±0.40	11.20 ^{ab} ±0.97	12.20 ^{ab} ±0.80	13.00 ^b ±1.00	13.20 ^b ±1.32	

Means bearing different superscripts differ significantly at corresponding intervals (P = 0.05)

*P<0.05=significant at 5% level

**P<0.01= significant at 1% level

Thereafter, no signs of salivation were observed till the end of observation. Comparison among different groups revealed that salivation was higher during in xylazine alone (Group A) followed by combination of xylazine and ketamine (Group C) and least in ketamine alone (Group B). Epidural xylazine administered in cows did not cause motor paralysis and animals remained in standing position. Systemic effects of xylazine, like partially closed eyes and excessive flow of saliva were also present (Patel *et al.*, 1996). Animals of Group C showed significantly ($P<0.01$) longer duration of analgesia (144.80 ± 2.26 minutes) as compared to animals of Group A and B i.e. (131.80 ± 3.42 minutes) and (28.60 ± 1.85 minutes) and respectively.

Animals of Group A, B and C showed complete recovery at (149.60 ± 1.74 minutes), (39.40 ± 1.42 minutes), (195.40 ± 2.83 minutes) post injection respectively. Group B animals showed a significantly ($P<0.01$) late recovery as compared to other two groups. An early onset of analgesia was recorded with xylazine in combination with Ketamine (Group C), followed by xylazine (Group A) and ketamine (Group B).

The mean heart rate and respiration rate decreased significantly ($P<0.05$) between 20 to 45 minutes in Groups A which became highly significant ($P<0.01$) between 10 to 75 in Group C. whereas, in Group B significant ($P<0.01$) increase in HR and RR was observed between 20 to 45 minutes. The mean rectal temperature decreased significantly ($P<0.05$) between 20 to 105 minutes in Groups A and C. Whereas, non significant changes in rectal temperature was observed in Group B throughout the period of observation.

Thus it is concluded that combination of xylazine and ketamine can be safely used for lumbar epidural analgesia in buffalo calves.

CONCLUSION

In the present study, lumbar epidural injection of xylazine, ketamine alone and in combination with ketamine produced complete analgesia of thorax and flank with moderate analgesia of inguinal, perineum, hind limbs and tail in buffalo calves. The transient physiological changes were compensated within 24 h. Thus xylazine, ketamine alone and in combination with ketamine can be safely used in clinical cases for thoraco-abdominal surgery.

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