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Research Article

EVALUATION OF ACEPROMAZINE-KETAMINE ANAESTHESIA IN BUFFALO CALVES

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ABSTRACT

The study was undertaken in six buffalo calves to evaluate acepromazine (0.15 mg/kg i.m.)-ketamine (2.0 mg/kg iv) anaesthesia. Ataxia with decreased spontaneous motor activity and relaxation of prepuce and scrotum was seen after administration of acepromazine. Loss of auditory reflex and swallowing reflex occurred and analgesia was observed after administration of ketamine. A significant decrease in haemoglobin and packed cell volume was observed after acepromazine administration. There was a significant hyperglycaemia and hypernatraemia during anaesthesia. Acepromazine–ketamine anaesthesia may be used safely in buffalo calves for short duration anaesthesia with less alteration in blood biochemical parameters.

Key words: Acepromazine, buffalo calves, ketamine

The cyclohexylamine derivatives have been used as dissociative anaesthetics and have cataleptic, analgesic and anaesthetic action, but no hypnotic properties. Ketamine produces profound analgesia without muscle relaxation, and tonic-clonic spasms of limb muscles may occur even in the absence of surgical or other stimulation (Hall *et al*., 2001). Pathak *et al*. (1982) also reported the muscular rigidity with ketamine in buffalo calves. Therefore use of muscle relaxants along with or prior to induction of anaesthesia with ketamine is mandatory. Acepromazine possesses antiemetic, anticonvulsant, antispasmodic, hypotensive and hypothermic properties (Pugh, 1964) and its administration produces muscle relaxation and no analgesic effect (Tranquilli *et al.,* 2007). A comprehensive and planned study on the effects of acepromazine in combination with ketamine has not been done in buffaloes. The present study was undertaken with the objective of evaluation of efficacy of acepromazine-ketamine as anaesthetic combination in buffalo calves.

MATERIALS AND METHODS

After approval of Institutional Animal Ethics Committee, six experimental trials were undertaken on clinically healthy male buffalo calves of 18 to 24 months of age, and weighing 190-280 kg. The animals were kept off-feed and water for 12 h. Acepromazine was administered @ 0.15 mg/kg intramuscularly (i.m.) and 15 min later ketamine was administered @ 2.0 mg/kg intravenously (i.v.). Various parameters investigated were: Behavioural changes (Spontaneous motor activity, weak time, down time, lowering of head, onset of salivation, urination, defaecation and lacrimation, vocalization, relaxation of muscles, swallowing reflex, palpebral reflex, corneal reflex, analgesia, return to sternal recumbency, regaining of head righting reflex, standing time with ataxia, browsing time and complete recovery without ataxia), rectal temperature, heart rate, respiratory rate, haemoglobin (Hb), packed cell volume (PCV), plasma glucose, blood urea nitrogen (BUN), creatinine, total proteins, albumin, sodium, potassium, chloride, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALKP), gamma glutamyl transpeptidase (GGT) and bilirubin. Various parameters were investigated before administration of the drug(s), at 15 min of acepromazine administration, at 5 min of ketamine administration, at recovery from the effect of the drug(s) and at 24 h of acepromazine administration. The statistical analysis of data was done by one-way-analysis of variance and Duncan's multiple range test (Duncan, 1955).

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RESULTS AND DISCUSSION

The effects of acerpromazine-ketamine combination on behavioural parameters in buffalo calves are shown in Table 1. Spontaneous motor activity decreased in five animals and ataxia was observed after the administration of acepromazine. Five animals stood calm and quiet. All phenothiazines exert a sedative action by depressing the

Table 1
Behavioural characteristics related to onset of CNS depression and recovery from CNS depression induced by administration of acepromazine-ketamine combination in buffalo calves

Reflexes		Mean time (min)±SE
Spontaneous motor activity decrease*		4.67±1.14
Weak time*		6.17±1.37
Salivation*		3.83±1.83
Muzzle dryness†		2.50±0.67
Ventral rotation of Eye ball†		1.67±0.21
Relaxation of muscle	Prepuce*	7.50±2.09
	Scrotum*	9.67±2.10
	limbs†	2.67±0.33
Auditory reflex	Loss†	1.83±0.17
	Regain†	11.33±0.76
Swallowing reflex	Loss†	2.33±0.21
	Regain†	9.00±1.30
Onset of analgesia	Fetlock†	2.50±0.22
	Abdomen†	2.17±0.17
	Base of horn†	2.17±0.17
	Base of tail†	2.17±0.17
	Ribs†	2.17±0.17
Regaining of muscle tone†		9.00±0.82
Regaining of head righting reflex†		10.50±0.85
Return to sternal recumbency†		14.50±1.52
Browsing time†		21.17±1.24
Standing with ataxia†		21.83±2.57
Complete recovery†		39.83±2.31

*minutes of acepromazine administration
†minutes of ketamine administration

brain stem and connection to the cerebral cortex (Riviere and Papich, 2009). The decrease in spontaneous motor activity and ataxia may be attributed to the tranquilizing effects and muscle relaxant property of acepromazine as also reported by Nain *et al.* (2010) and Singh *et al*. (2011) in buffalo calves. The prepuce and scrotum were relaxed after acepromazine administration in five animals. Phenothiazines provide good muscle relaxation and often used in conjunction with anaesthetics that do not provide muscle relaxation or that result in muscle rigidity (Riviere and Papich, 2009). Salivation in drops was observed in three animals while lacrimation was observed in one animal after acepromazine administration which might be due to temporary para-sympathetic excitation (Lakshmipathy and Vijayakumar, 1980). Transient apnoea was observed in two animals for 4 and 5 sec after ketamine administration, however, the animals regained respiration without any resuscitation. When other CNS depressants are administered with ketamine, significant respiratory depression can be seen (Riviere and Papich, 2009). Palpebral reflex was present in all animals. Animals under anaesthesia showed intact palpebral and corneal reflexes. This is in contrary to the findings in buffalo claves under midazolam-ketamine (Kumar *et al.,* 2014) and in goats under acepromazine-ketamine (Kumar *et al*., 1976) anaesthesia. Analgesia was observed (by needle pricks) at fetlock, base of tail, abdomen, ribs, periosteum and base of horn in all the animals. The analgesia might be mediated by the antagonistic effects of ketamine on N-methyl-D-aspartate (NMDA) receptor (Kohrs and Durieux, 1998). The NMDA receptor is also involved in pain processing, including central and peripheral sensitization and visceral pain (Riviere and Papich, 2009). The analgesia at fetlock, base of tail, abdomen, ribs, periosteum and base of horn was also observed in buffalo calves after midazolam-ketamine anaesthesia (Kumar *et al.,* 2014). The animals stood up, though with ataxia at 21.83±2.57 min of ketamine administration. Two animals show praying posture with knee down for 10-20 sec while standing. Complete recovery took 39.83±2.31 min of ketamine administration.

The effects of acepromazine-ketamine combination on rectal temperature, heart rate and respiratory rate are shown in Table 2. There was no significant change in rectal temperature during the entire period of experiment corresponding to non-significant increase in ambient temperature. All phenothiazine derivatives have been stated to cause a fall in body temperature partly due to increased heat loss because of the resetting of the central thermoregulatory mechanisms (Hall *et al*., 2001). Hypothermic effect has also been linked with the depletion of catecholamine substances within the hypothalamus. Nain *et al.* (2010) observed no significant change in rectal temperature in buffalo calves after administration of

Table 2
Mean values (±S.E) of rectal temperature, heart rate and respiratory rate in buffalo calves with acepromazine-ketamine anaesthesia

Parameters (Units)	Before administration of acepromazine	At 15 min of acepromazine administration	At 5 min of ketamine administration	At recovery	At 24 h of acepromazine administration
Ambient temperature (°C)	29.67^{a}±0.91	30.00^{a}±0.86	30.00^{a}±0.86	30.00^{a}±0.86	31.17^{a}±0.87
Rectal temperature (°C)	36.93^{a}±0.23	37.20^{a}±0.09	37.17^{a}±0.17	37.02^{a}±0.15	37.23^{a}±0.09
Heart rate (beats/min)	47.83^{a}±0.98	54.83^{a}±3.54	46.67^{a}±5.16	46.83^{a}±0.90	52.83^{a}±1.42
Respiratory rate (breaths/min)	15.50^{a}±1.38	13.83^{a}±1.22	14.33^{a}±1.97	14.50^{a}±1.47	16.17^{a}±1.32

Means with same superscripts in a raw do not vary significantly (p>0.05)

Table 3

Mean values (± S.E) of haematological and biochemical parameters in buffalo calves before and after acepromazine-ketamine anaesthesia

Parameters (units)	Before administration of acepromazine	At 15 min of acepromazine administration	At 5 min of ketamine administration	At recovery	At 24 h of acepromazine administration
Haemoglobin (g/dl)	10.70^{b}±0.23	9.55^{a}±0.29	9.27^{a}±0.27	8.93^{a}±0.26	10.52^{b}±0.14
Packed cell volume (%)	32.80^{c}±0.80	30.00^{b}±1.20	28.72^{ab}±0.74	26.82^{a}±0.97	32.83^{c}±0.38
Plasma glucose (mg/dl)	60.90^{a}±2.81	70.80^{ab}±2.53	77.37^{b}±3.72	78.48^{b}±6.31	70.03^{ab}±2.61
BUN (mg/dl)	28.70^{a}±0.74	28.12^{a}±0.56	28.59^{a}±0.46	28.03^{a}±0.49	29.06^{a}±1.12
Creatinine (mg/dl)	1.56^{a}±0.41	1.53^{a}±0.42	1.55^{a}±0.41	1.60^{a}±0.42	1.97^{a}±0.34
Total proteins (g/dl)	8.12^{a}±0.32	7.83^{a}±0.23	7.72^{a}±0.19	7.44^{a}±0.11	8.07^{a}±0.28
Albumin (g/dl)	3.29^{a}±0.17	3.20^{a}±0.16	3.19^{a}±0.16	3.17^{a}±0.10	3.43^{a}±0.16
Sodium (mmol/L)	142.30^{a}±1.71	148.87^{bc}±1.92	151.88^{c}±1.84	144.33^{ab}±2.13	148.33^{bc}±2.00
Potassium (mmol/L)	4.66^{a}±0.41	4.48^{a}±0.40	4.44^{a}±0.46	3.87^{a}±0.40	4.20^{a}±0.21
Chloride (mmol/L)	93.41^{a}±2.02	90.72^{a}±0.76	88.72^{a}±2.15	87.71^{a}±4.72	91.60^{a}±1.08
ALT (IU/L)	48.88^{a}±5.91	48.03^{a}±5.73	50.33^{a}±5.91	51.00^{a}±5.53	48.50^{a}±4.04
AST (IU/L)	161.83^{a}±4.60	154.63^{a}±9.23	150.12^{a}±7.60	149.23^{a}±9.04	179.17^{a}±20.78
ALKP (IU/L)	48.50^{a}±10.51	46.33^{a}±10.85	45.00^{a}±10.50	45.83^{a}±8.30	41.66^{a}±10.29
GGT (IU/L)	11.65^{a}±2.96	12.43^{a}±1.69	11.10^{a}±1.25	10.68^{a}±1.33	10.63^{a}±1.14
Bilirubin (mg/dl)	0.29^{a}±0.06	0.34^{a}±0.07	0.33^{a}±0.07	0.31^{a}±0.05	0.44^{a}±0.16

BUN=blood urea nitrogen; ALT=Alanine aminotransferase; AST=Aspartate aminotransferase; ALKP=Alkaline phosphatase; GGT=Gamma glutamyl transpeptidase.

Means with different superscripts for a parameter in a row vary significantly ($p<0.05$)

acepromazine. A non-significant increase in heart rate was observed at 15 min of acepromazine administration which non-significantly decreased at 5 min of ketamine administration as compared to the base value. Phenothiazines affect the cardiovascular system by depression of the central and the sympathetic nervous systems and by direct action on the myocardial and vascular smooth muscle (Soma, 1971). The latter results in decreased cardiovascular reactivity to postural changes, negative cardiac ionotropy and peripheral vasodilatation, usually with a compensatory tachycardia. Singh *et al*. (2011) also observed a significant increase in heart rate at 10 min of acepromazine administration in buffalo calves. Nain *et al*. (2010) observed a significant increase in heart rate after acepromazine administration in buffalo calves. There was a non-significant decrease in respiratory rate at 15 min of acepromazine administration as compared to the base value. Clinical doses of acepromazine have little effect on respiration and although, sedated animals may breathe more slowly the minute volume of respiration is usually unchanged (Muir *et al.,* 1975; Tobin and Ballard, 1979).

The effects of acepromazine-ketamine combination on haemato-biochemical parameters are shown in Table 3. A significant decrease in Hb was observed at 15 min of acepromazine administration which further decreased significantly at 5 min of administration of ketamine and remained significantly lower at the recovery as compared to the base value. There was a significant decrease in PCV at 15 min of acepromazine administration and at 5 min of ketamine administration and at recovery as compared to the base value. This decrease in Hb and PCV could be attributed to splenic pooling of blood constituents (Hewson *et al.,* 2006; Welberg *et al.,* 2006).

The plasma glucose level increased, though non-significantly, at 15 min of acepromazine administration. There was a significant hyperglycaemia at 5 min of ketamine administration which further increased at recovery as compared to the base value. The hyperglycaemia may be due to release of catecholamine in a stressful condition during anaesthesia thereby resulting in glycogenolysis (Tammisto *et al.*, 1982). It may be accounted for either to decreased glucose utilization, impaired insulin activity or increased adrenocortical hormone (Kumar *et al.*, 1989). Moreover, during the period of anaesthesia, there is decrease in basal metabolic rate of the animal and muscular activity is negligible, so utilization of glucose by muscles is also decreased probably causing slight increase in glucose concentration. Hyperglycaemia produced in this study was transient in nature and within

the normal physiological limit, so a clinical significance cannot be attached.

Sodium level increased significantly at 15 min of acepromazine administration and at 5 min of ketamine administration as compared to the base value. It may be due to withholding feed and water or excess of mineralocorticoids (Carlson, 1997). The variations in concentrations of serum sodium, potassium and chloride were within the normal physiological limits and the same findings were also observed in goats under ketamine anaesthesia (Kumar *et al.,* 1976). However, Singh *et al.* (1985) did not find any significant change in the plasma concentration of electrolytes after administration of xylazine-ketamine in buffalo calves.

It can, therefore, be concluded that the blood dilution has not been caused by water or electrolyte retention, but most probably by the increased temporary migration of interstitial fluid to the vascular system. A significant increase in sodium has also been observed in buffalo calves under atropine-acepromazine-xylazine-ketamine anaesthesia (Singh *et al*., 2011). There were no significant variations in other blood biochemical parameters and the value remained within the clinical limits. So, based on the observations of the study, it is concluded that acepromazine-ketamine induced less alterations in blood biochemical parameters and may safely be used for short duration (10 min) anaesthesia in buffalo calves.

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