

ANALGESIC EFFECTS OF MEDETOMIDINE ON HEALTHY CATTLE CALVES

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ABSTRACT: An experimental study was conducted to observe the analgesic effects produced by intravenous administration of three different doses of medetomidine (8µg/kg, 10µg/kg and 12µg/kg) in six healthy cattle calves in 2008. Various observations regarding onset of skin analgesia, duration of skin analgesia, onset of recumbency and duration of recumbency were recorded upto 120 minutes. Skin analgesia was produced in all animals with higher doses (10µg/kg and 12µg/kg) and in only two animals with lower doses (8µg/kg). Its onset was at 13.00±2.753, 6.25±0.75 and 2.33±0.21 minutes while mean total duration was 36.00±7.59, 55.66±5.53 and 93.00±0.57 minutes with 8µg/kg, 10µg/kg and 12µg/kg of medetomidine respectively which was significantly different ($P<0.01$) with all three doses. Medetomidine produced recumbency in all animals with higher doses (10µg/kg and 12µg/kg) and only in two animals with 8µg/kg body weight. Onset of recumbency were 6.25±1.31, 3.50±0.18 and 1.50±0.18 minutes while its duration was recorded as 48.50±10.23, 70.83±2.42 and 100.00±0.57 minutes after administration of 8µg/kg, 10µg/kg and 12µg/kg medetomidine respectively.

Key words: Analgesic, recumbency, skin, duration, medetomidine.

INTRODUCTION

The development and progress in veterinary drugs has contributed well in the veterinary practice. Medetomidine is the newest alpha2-agonist to be approved for veterinary uses. It is lipophilic, is rapidly eliminated and possesses more potency and economic efficacy than other alpha2-agonists (Miksa *et al.*, 2005). Its alpha2/alpha1-receptor selectivity binding ratio is 1620 compared to 260, 220 and 160 for detomidine, clonidine and xylazine, respectively. Medetomidine is developed primarily as sedative for use in dog and cat. It is about 30 to 40 times as potent as xylazine. Medetomidine produces a reliable degree of sedation, muscle relaxation and analgesia in a variety of domesticated animals. (Kojima *et al.*, 2002). The development of new sedative and analgesics in recent years has greatly contributed in the veterinary practice. To reduce stress and control pain xylazine, romifidine, detomidine, and medetomidine are frequently used in veterinary anesthesia as safe and effective drugs. Alpha2 adrenergic agonist and antagonists have a significant role in this development of patient care (Lee *et al.*, 2004). Alpha2 receptor agonist drugs are mostly used in large animals but are rarely used in human beings. (Johnston *et al.*, 2002). The use of medetomidine in buffalo calves has been reported (Pettifer and Dyson, 1993). Medetomidine has marked cardiovascular effects such as bradycardia; arterial hypertension followed by hypotension and reduced cardiac output. In most cases medetomidine

slows respiration. The solution is non irritant and can be administered by subcutaneous, intramuscular and intravenous route. Its effects can be antagonized by the alpha2 antagonist atipamezole (Grimm *et al.*, 1998). Some studies have been reported regarding sedative, analgesic and various physiological effects of medetomidine in horses, cats, sheep, goats, ferrets, rabbits, elephants and buffalo calves (Muhammad *et al.*, 1989; Nilsfors *et al.*, 1989; Bryant *et al.*, 2004, Lee *et al.*, 2004, Abass *et al.*, 2005 and Raiha *et al.*, 2005). However, very limited work has been done on the use of medetomidine in cattle calves (Tomizawa *et al.*, 1989 and Ryeng *et al.*, 2001). Therefore this study was conducted to determine economical dose rate and its analgesic physiological effects in cattle calves under same experimental conditions.

MATERIALS AND METHODS

Six healthy red Sindhi cattle calves with an average age of 8 months and weighing 56.16kg were used in this study in 2008.

Analgesic effects of medetomidine: Onset and duration of skin analgesia as well as onset and duration of recumbency in each animal was recorded with each treatment. Nature and safety of analgesic effect was checked by deep needle pricking at various body parts.

Statistical analysis of data: Analysis of data was performed by using analysis of variance (ANOVA) and Duncan Multiple Range Test (DMRT).

RESULTS AND DISCUSSIONS

Analgesic effects of medetomidine

Onset of skin analgesia: The mean values for onset of skin analgesia were 13.00 ± 2.75 , 6.25 ± 0.75 and 2.33 ± 0.21 minutes after administration of $8 \mu\text{g/kg}$, $10 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ of medetomidine respectively (Table 1). The onset of skin analgesia was dose dependent, with high dose producing more rapid effect. Statistical analysis showed that there was significant difference ($P < 0.01$) amongst all three doses of medetomidine (Lee *et al.*, 2004).

Table 1: Onset of skin analgesia (minutes) after administration of medetomidine

Animal No.	Doses of Medetomidine		
	$8 \mu\text{g/kg}$	$10 \mu\text{g/kg}$	$12 \mu\text{g/kg}$
1	14	4	2.5
2	-	5	2.5
3	-	4.5	2
4	12	5	2.5
5	-	4	3
6	-	5	1.5
Mean	$13.00 \pm 2.75^{++rr}$	$6.25 \pm 0.75^{++**}$	$2.33 \pm 0.21^{rr**}$
++	Highly significant difference ($P < 0.01$) between $8 \mu\text{g/kg}$ and $10 \mu\text{g/kg}$ body weight group		
rr	Highly significant difference ($P < 0.01$) between $8 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ body weight group		
**	Highly significant difference ($P < 0.01$) between $10 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ body weight group		

Duration of skin analgesia: The mean values for duration of skin analgesia were 36.00 ± 7.59 , 55.66 ± 5.53 and 93.00 ± 0.57 minutes after administration of $8 \mu\text{g/kg}$, $10 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ of medetomidine respectively (Table 2). The duration of skin analgesia was dose dependent which increased with increasing dose of medetomidine. Statistical analysis showed that duration of skin analgesia was highly significantly different ($P < 0.01$) with all three doses (Tomizawa *et al.*, 1992).

Table 2. Total duration of skin analgesia (minutes) after administration of medetomidine.

Animal No.	Doses of medetomidine		
	$8 \mu\text{g/kg}$	$10 \mu\text{g/kg}$	$12 \mu\text{g/kg}$
1	37	68	92
2	--	66	94
3	--	40	91
4	35	43	93
5	--	69	95
6	--	47	93

Mean	$36.00 \pm 7.59^{++rr}$	$55.66 \pm 5.53^{++**}$	$93.00 \pm 0.57^{rr**}$
++	Highly significant difference ($P < 0.01$) between $8 \mu\text{g/kg}$ and $10 \mu\text{g/kg}$ body weight group		
rr	Highly significant difference ($P < 0.01$) between $8 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ body weight group		
**	Highly significant difference ($P < 0.01$) between $10 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ body weight group		

Onset of recumbency: The mean values for onset of recumbency were 6.25 ± 1.31 , 3.50 ± 0.18 and 1.50 ± 0.18 minutes after administration of $8 \mu\text{g/kg}$, $10 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ of medetomidine respectively (Table 3). The data suggested that the time for onset of recumbency has inversely related with the dosage of drug. Increasing the economic usage of dosage resulted in quick recumbency. Onset of recumbency was significantly different ($P < 0.05$) on comparison of $10 \mu\text{g/kg}$ with $8 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ while highly significant ($P < 0.01$) between $8 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ doses of medetomidine (Vainio *et al.*, 1989).

Table 3: Onset of recumbency (minutes) after administration of medetomidine

Animal No.	$8 \mu\text{g/kg}$	$10 \mu\text{g/kg}$	$12 \mu\text{g/kg}$
1	6.00	3.00	1.50
2	--	4.00	2.00
3	--	3.00	1.00
4	6.50	3.50	2.00
5	--	4.00	1.50
6	--	3.50	1.00
Mean	$6.25 \pm 1.31^{+rr}$	$3.50 \pm 0.18^{+*}$	$1.50 \pm 0.18^{rr*}$
+	Significant difference ($P < 0.05$) between $8 \mu\text{g/kg}$ and $10 \mu\text{g/kg}$ body weight group		
rr	Highly significant difference ($P < 0.01$) between $8 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ body weight group		
*	Significant difference ($P < 0.05$) between $10 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ body weight group		

Duration of recumbency: The duration of recumbency was 48.50 ± 10.23 , 70.83 ± 2.42 and 100.00 ± 0.57 minutes after administration of $8 \mu\text{g/kg}$, $10 \mu\text{g/kg}$ and $12 \mu\text{g/kg}$ of medetomidine respectively (Table 4). The duration of recumbency was dose dependent and increased with increasing dose of medetomidine. Further analysis by DMR test showed significant difference ($P < 0.05$).

Table 4: Duration of recumbency (minutes) after administration of medetomidine.

Animal No.	$8 \mu\text{g/kg}$	$10 \mu\text{g/kg}$	$12 \mu\text{g/kg}$
1	47	74	99
2	--	76	101
3	--	65	98
4	50	68	100
5	--	78	102
6	--	64	100
Mean	$48.50 \pm 10.23^{+rr}$	$70.83 \pm 2.42^{+++}$	$100.00 \pm 0.57^{rr**}$

- + Significant difference ($P<0.05$) between 8 $\mu\text{g/kg}$ and 10 $\mu\text{g/kg}$ body weight group
 rr Highly significant difference ($P<0.01$) between 8 $\mu\text{g/kg}$ and 12 $\mu\text{g/kg}$ body weight group
 ** Highly significant difference ($P<0.01$) between 10 $\mu\text{g/kg}$ and 12 $\mu\text{g/kg}$ body weight group

between 10 $\mu\text{g/kg}$ and 8 $\mu\text{g/kg}$ and 10 $\mu\text{g/kg}$ and 12 $\mu\text{g/kg}$ and highly significant difference ($P<0.01$) between 8 $\mu\text{g/kg}$ and 12 $\mu\text{g/kg}$ doses of medetomidine (Muhammad *et al.*, 2006).

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