SEDATIVE EFFECTS OF MEDETOMIDINE ON PULSE RATE, RESPIRATORY RATE AND BODY TEMPERATAURE IN CATTLE CALVES

M. Tariq, A. B. Kalhoro[*], A. B. Kachiwal[*], A. Akhtar and M. Niamatullah[**]

Gomal College of Veterinary Sciences, Gomal University, D. I. Khan, Pakistan, [*]Department of Surgery and Obstetrics, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University Tandojam
[**]Faculty of Agriculture, Gomal University, D.I.Khan, Pakistan,
Corresponding author email: amandrdik@gmail.com

ABSTRACT: Study was carried out to compare the sedative, analgesic effects of medetomidine administered @ (8µg/kg, 10µg/kg and 12µg/kg) intravenously in six healthy cattle calves. Observations on pulse rate, respiratory rate and body temperature were recorded upto 120 minutes. The pulse rate, and respiratory rate decreased significantly ($P<0.01$) after 5 minutes of administration of medetomidine. However, body temperature decreased significantly ($P<0.05$) after 5 minutes of administration of medetomidine. Onset of sedation was observed at 26.00±0.36, 21.00±0.56 and 16.00±0.43 seconds respectively. Onset and duration of sedation were significantly different ($P<0.01$) among all three doses. Although all three doses of medetomidine produced significant changes in pulse and respiratory rates and body temperature yet these changes were transient in nature and all parameters had returned to base line within two hours. Therefore, care should be taken while using medetomidine in such patients.

Key words: Sedative, medetomidine, cattle, pulse rate, respiratory rate, body temperature.

INTRODUCTION

Cattle, commonly referred to as cows, are domesticated ungulates, a member of the subfamily Bovine of the family Bovidae. Cattle form an important and integral part of small agriculture land holder, and contributes to the livestock industry in terms of milk, meat and hides (McCormick, 2001). Prevention and treatment of various health problems are mandatory to obtain maximum milk and mutton production from the animals. More often, livestock suffer from some surgical problems, requiring regional and local anaesthesia and surgical intervetion (Khan *et al*., 2004).There are some risks with the use of general anesthetics in cattle therefore many surgical procedures are usually performed by using a combination of physical restraint, sedation and local or regional anesthesia. This technique is usually simple, inexpensive and provide a reversible loss of sensation to a relatively well defined area of the body for various surgical interventions (Muhammad *et al*., 1993).

The development of new sedative / analgesics in recent years has greatly contributed to the progress made by the veterinary practice. These developments have resulted in a means of reducing stress, prevention or control of pain and safe and efficient xylazine, romifidine, detomidine, and medetomidine are used frequently in veterinary anesthesia (Ranheim *et al*., 1999). Alpha2 antagonists have a significant role in this development of patient care (Misse *et al*., 2002). Alpha2 receptor agonist drugs such as species (particularly large animal), but are rarely used in humen beings (Raekallio *et al.*, 2008). Medetomidine has also been used in cattle and sheep; I.V. doses of 10 to 20 µg/kg cause sedation similar to that seen after 0.1 to 0.2 mg/kg of xylazine. There are some reports of the use of medetomidine in buffalo calves (Arnemo and Soli, 2005). Medetomidine is commonly used as a preanesthetic prior to ketamine, barbiturate, or mask induction with an inhalation anesthetic (Mpanduji *et al*., 2000). Combinations with ketamine are more effective than the sedative alone (Rioja *et al.*, 2008).

MATERIALS AND METHODS

Six healthy Red Sindhi cattle calves with an average age of 8.16months and weighing 56.16kgs were used in this study. The calves were kept at livestock farm, department of Livestock Management, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam. The calves were allowed to adapt to the surroundings for at least two weeks before experiment. They were given thorough physical examination and dewormed with Nilzan®(ICI Pakistan). Calves were vaccinated against anthrax, and hemorrhagic septicemia. All the calves were ear tagged with numbers 1-6. Before start of each experiment the calf was weighed and then brought to the surgery hall for the experiment. The hairs over the left and right jugular vein were clipped with an automatic hair clipper and the skin sites were disinfected with an antiseptic (70% alchohal). The drug was injected slowly. For precise dosage 1ml disposable syringe was used. The dosage was calculated on the basis

of animal's body weight. The three dose rates of medetomidine 8µg/kg, 10µg/kg and 12µg/kg were used in this study intravenously.

Parameters recorded

Pulse rate: Pulse rate (beats/minute) was recorded before administration of medetomidine (as control) and then every 5 minutes up to 120 minutes after induction of sedation. Pulse rate was determined by auscultation of heart sounds with stethoscope at left side of the calves.

Respiratory rate: Respiratory rate (breaths / minute) was recorded before administration of medetomidine (as control) and then every 5 minutes up to 120 minutes after administration of medetomidine.

Body temperature: Body temperature was recorded before administration of medetomidine (as control) and then every 5 minutes after administration of medetomidine up to 120 minutes. Body temperature was determined by placing clinical thermometer in rectum of animal for at least one minute.

Sedative effects of medetomidine: The degree, duration and onset of sedation as well as nature and duration of recovery, standing time, onset of recumbency and duration of recumbency in each animal was recorded with each treatment.

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

RESULTS AND DISCUSSION

Pulse rate: Pretreatment (control) mean values of pulse rate of cattle calves were 81.00±0.36, 80.83±0.30 and 80.66±0.33 per minute with 8µg/kg, 10µg/kg and 12µg/kg body weight of medetomidine respectively as mentioned in Table 1. The pulse rate decreased significantly (P<0.01) after 5 minutes of administration of medetomidine. It continued to decrease further up to 45, 60 and 75 minutes with 8µg/kg, 10µg/kg and 12µg/kg body weight respectively . Comparison between three different doses revealed that there was significant difference (P<0.01) in pulse rate. The effect of medetomidine on pulse rate was dose dependent with higher dose producing more depression and longer lasting effect (Sing *et al*., 2006).

Table. 1 Mean pulse rate / minute of cattle calves after administration of medetomidine.

Time interval	Medetomidine dose groups		
Minutes	8 µg / kg	10 µg / kg	12 µg / kg
Control	81.00±0.36	80.83±0.30	80.66±0.33
05	77.50±0.22**++ΔΔ	75.50±0.22**++rr	73.50±0.22**ΔΔrr
15	70.50±0.22**++ΔΔ	68.00±0.36**++rr	65.00±0.36**ΔΔrr
30	62.00±0.36**++ΔΔ	59.50±0.22**++rr	57.50±0.22**ΔΔrr
45	55.50±0.22**++ΔΔ	53.50±0.22**++rr	51.50±0.22**ΔΔrr
60	62.00±0.36**++ΔΔ	49.00±0.36**++rr	47.16±0.30**ΔΔrr
75	71.66±0.33**++ΔΔ	59.33±0.21**++rr	43.00±0.36**ΔΔrr
90	80.83±0.40++ΔΔ	70.50±0.22**++rr	56.00±0.36**ΔΔrr
105	80.66±0.33ΔΔ	80.66±0.33rr	67.50±0.22**ΔΔrr
120	80.83±0.40	80.50±0.34	80.50±0.22

** Highly significant difference (P<0.01) from corresponding control value
++ Highly significant difference (P<0.01) between values for 8 µg / kg and 10 µg / kg body weight group
ΔΔ Highly significant difference (P<0.01) between values for 8 µg / kg and 12 µg / kg body weight group
rr Highly significant difference (P<0.01) between values for 10 µg / kg and 12 µg / kg body weight group

Respiratory rate: Pretreatment (control) mean values of respiratory rate of cattle calves were 29.16±0.36, 28.83±0.30 and 29.16±0.40 per minute with 8µg/kg, 10µg/kg and 12µg/kg body weight of medetomidine respectively as reflected in Table 2. The respiratory rate decreased significantly (P<0.01) after 5 minutes of administration of medetomidine. It continued to decrease further up to 45, 60 and 75 minutes with 8µg/kg, 10µg/kg and 12µg/kg body weight respectively. Comparison between three different doses revealed that there was significant difference (P<0.01) in respiratory rate. The effect of medetomidine on respiratory rate was dose dependent with higher dose producing more depression and longer lasting effect (Waldridge *et al.*, 1997).

Body Temperature: Pretreatment (control) mean values of body temperature of cattle calves were 102.36±0.17, 102.53±018 and 102.30±0.13 per minute with 8 µg/kg, 10 µg/kg and 12 µg/kg body weight of medetomidine respectively as revealed in Table 3. The body temperature decreased significantly (P<0.05) after 5 minutes of administration of medetomidine. It continued to decrease up to 45, 60 and 75 minutes with 8µg/kg, 10µg/kg and 12µg/kg body weight respectively. Comparison between three different doses revealed that there was a significant

difference (P<0.01) in body temperature. The effect of medetomidine on body temperature was dose dependent with higher dose producing more decrease and longer lasting effect (Misse *et al*., 2002).

Table 2. Mean respiratory rate / minute of cattle calves after administration of medetomidine.

Time interval	Medetomidine dose groups		
Minutes	8 µg / kg	10 µg / kg	12 µg / kg
Control	29.00±0.36	28.83±0.30	29.16±0.40
05	26.50±0.22**+ΔΔ	25.50±0.22**+rr	23.50±0.22**ΔΔrr
15	24.50±0.22**++ΔΔ	22.50±0.22**++r	21.50±0.22**ΔΔr
30	21.50±0.22**++ΔΔ	19.50±0.22**++r	18.50±0.22**ΔΔr
45	18.50±0.22**+ΔΔ	17.50±0.22**+rr	15.50±0.22**ΔΔrr
60	22.50±0.22**++ΔΔ	15.50±0.22**++rr	13.83±0.22s**ΔΔrr
75	25.50±0.22**++ΔΔ	19.50±0.22**++rr	11.50±0.22**ΔΔrr
90	28.83±0.30++ΔΔ	24.50±0.22**++rr	18.66±0.33**ΔΔrr
105	28.66±0.33ΔΔ	28.50±0.34rr	24.00±0.25**ΔΔrr
120	28.63±0.40	28.66±0.33	29.00±0.36

** Highly significant difference (P<0.01) from corresponding control value
+ Significant difference (P<0.05) between values for 8µg/kg and 10µg/kg group
++ Highly significant difference (P<0.01) between values for 8 µg / kg and 10 µg / kg body weight group
ΔΔ Highly significant difference (P<0.01) between values for 8 µg / kg and 12 µg / kg body weight group
rr Highly significant difference (P<0.01) between values for 10 µg / kg and 12 µg / kg body weight group

Table. 3 Mean body temperature (^{0}F) of cattle calves after administration of medetomidine.

Time interval	Medetomidine dose groups		
Minutes	8 µg / kg	10 µg / kg	12 µg / kg
Control	102.36±0.03	102.53±0.04	102.30±0.13
05	102.20±0.02Δ	102.10±0.04*	101.90±0.04*Δ
15	102.00±0.03+ΔΔ	101.70±0.04**+	101.50±0.04**ΔΔ
30	101.80±0.01**++ΔΔ	101.40±0.02**++	101.16±0.03**ΔΔ
45	101.56±0.03**+ΔΔ	101.20±0.01**+	101.13±0.21**ΔΔ
60	101.86±0.04*Δ	100.80±0.01**r	100.50±0.04**Δr
75	102.26±0.04++ΔΔ	101.40±0.01**++rr	100.30±0.04**ΔΔrr
90	102.30±0.13ΔΔ	102.10±0.04*rr	101.10±0.04**ΔΔrr
105	102.36±0.17ΔΔ	102.46±0.19rr	101.93±0.04*ΔΔrr
120	102.36±0.17	102.43±0.18	102.20±0.12

* Significant difference (P<0.05) from corresponding control value
** Highly significant difference (P<0.01) from corresponding control value
+ Significant difference (P<0.05) between values for 8µg/kg and 10µg/kg group
++ Highly significant difference (P<0.01) between values for 8 µg / kg and 10 µg / kg body weight group
Δ Significant difference (P<0.05) between values for 8 µg / kg and 12 µg / kg body weight group
ΔΔ Highly significant difference (P<0.01) between values for 8 µg / kg and 12 µg / kg body weight group
r Significant difference (P<0.05) between values for 10 µg / kg and 12 µg / kg body weight group
rr Highly significant difference (P<0.01) between values for 10 µg / kg and 12 µg / kg body weight group

Table 4. Onset of sedation (second) after administration of medetomidine.

Animal No.	Doses of medetomidine		
	8µg/kg	10µg/kg	12µg/kg
1	25	19	18
2	27	22	15
3	26	18	14
4	27	24	16
5	25	23	18
6	26	21	15
Mean	26.00±0.36++rr	21.00±0.56++**	16.00±0.43rr**

rr Highly significant difference (P<0.01) between 8 µg/kg and 12µg/kg body weight group
++ Highly significant difference (P<0.01) between 8 µg/kg and 10µg/kg body weight group
** Highly significant difference (P<0.01) between 10 µg/kg and 12µg/kg body weight group

Sedative effects of medetomidine: Table 4 mentioned the mean values for onset of sedation in cattle calves were 26.00±0.36, 21.00±0.56 and 16.00±0.43 seconds after administration of 8µg/kg, 10µg/kg and 12µg/kg of medetomidine respectively. Analysis of variance showed that the onset of sedation was significantly different (P<0.01) with all three doses and further analysis by DMR test showed that the onset of sedation was significantly rapid (P<0.01) with 12µg/kg as compared to 8µg/kg and 10µg/kg. The onset of sedation was therefore dose dependent, with higher doses producing more rapid

effect (Rioja *et al*., 2006; Kastner *et al*., 2003; Carroll *et al*., 2005).

REFERENCES

Arnemo, J. M. and N. E. Soli. Chemical capture of free-ranging cattle: Immobilization with xylazine or medetomidine, and reversal with atipamezole. Vet. Res. Com, 17(3): 469-477 (2005).

Carroll, G. L., E. A. Martinez, E. L. Haley, S. C. Geller, S. M. Hartsfied and T. H. Champney. Effects of medetomidine and its antagonism with antipamezole on stress related harmones, metabolities, physiological responses, sedation and mechanical threshold in goats. Vet. Anaesth. Analg. 32(3): 147-157 (2005).

GOP. Economic Survey of Pakistan 2008-2009, Federal Bureau of Statistics (Economic Wing), Govt. Pakistan, Islamabad (2009).

Kastner, S. B., K. Feige, M. Huhtinen, M. K. Akens, P. Wapf and W. R. Bettschart. Pharmacoknetics and sedative effects of intramuscular medetomidine in domestic sheep. Vet. Pharm. Ther. 26(4): 271-276 (2003).

Khan, M. A., M. Ashraf, K. Pervez, H. B. Rashid, A. K. Mahmood and M. Chaudhry. Comparative effects of Medetomidine and Xylazine as sedative and analgesic agents in small ruminants. Pakistan Vet. J. 24 (2): 78-83 (2004).

McCormick, I. B. The antinociceptive effects of epidurally administered morphine and xylazine in calves. Cattle Practice. 9(1): 7-10 (2001).

Misse, V., M. Raekallio, E. Kuusela, P. Huttunen, J. Leppäluoto, P. Kirves and O. Vainio. Evaluation of the perioperative stress response in dogs administered medetomidine or acepromazine as part of the preanesthetic medication. Am. J. Vet. Res. 63(7): 969-975 (2002).

Mpanduji, D. G., E. K. Batamuzi, M. N. Mgasa and S. B. Bittegeko. Analgesic, behavioural and cardiopulmonary effects of epidurally injected medetomidine (Domitor) in goats. J. Vet. Med. 47(2): 65-72 (2000).

Muhammad, F. K., A. R. A. Latif and I. K. Zangana. Medetomidine sedative in sheep. J. Vet. Med. Iraq. 40 : 328-331 (1993).

Raekallio, M., M. Kivalo, H. Jalanka and O. Vainio. Medetomidine /Ketamine sedation in cattle calves and its reversal with atipamezole. J. Vet. Anaesth. Analg. 18(1): 45-47 (2008).

Ranheim, B., J. M. Arnemo, K. A. Ryeng, N. E. Soli and T. E. Horsberg. A pharmacokinetic study including some relevant clinical effects of medetomidine and atipamezole in lactating dairy cows. J.Vet.Pharm.Therap. 22(6): 368-373 (1999).

Rioja, E. L., K. Carolyn, S. E. Saad and N. M. Wayne. Sedative and cardiopulmonary effects of medetomidine hydrochloride and xylazine hydrochloride and their reversal with atipamezole hydrochloride in calves. Am. J. Vet. Res. 4(2): 273-276 (2006).

Rioja, E., C. L. Kerr, S. E. Saad and W. N. McDonell. Sedative and cardiopulmonary effects of medetomidine hydrochloride and xylazine hydrochloride and their reversal with atipamezole hydrochloride in calves. Am. J. Vet. Res. 69(3): 319-329 (2008).

Singh, S., Amarpal, P. Kinjavdekar, H. P. Aithal and K. Pratap. Haemato- biochemical changes after epidural analgesia with xylazine, medetomidine, bupivacaine and their combinations in buffalo calves. Ind. J. Anim. Sci. 76(3): 236-238 (2006).

Waldridge, B. M., H. C. Lin, F. J. D. Graves and D. G. Pugh. Sedative effects of medetomidine and its reversal by atipamezole in cattle calves. J. Am.Vet. Med. Assoc. 211(12): 1562-1565 (1997).