Effects of medetomidine on serum glucose in cattle calves

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Abstract: An experimental study was carried out to compare physiological effects (serum glucose level) of medetomidine in Red Sindhi cattle calves at three different doses i.e. 8, 10 and 12µg/kg body weight intravenously. Medetomidine produced a dose dependent significant ($P<0.01$) increase in serum glucose level with a maximum increase observed at 30 minutes with 8µg/kg, 10µg/kg and 12µg/kg body weight respectively. Start of sedation, degree of sedation and total duration of sedation were all dose dependent and the values obtained were significantly ($P<0.01$) different from each other. It was observed that the sedation was rapid, deep and longer with the higher doses of medetomidine i.e. 12µg/kg. The results of the present study shows that medetomidine is a very effective and safest drug use as sedative for calves which in lower doses (8µg/kg) can be used as a pre-anesthetic and for restraining of the animal, while higher calculated doses (10µg/kg, 12µg/kg) can be used to execute the minor surgical procedures.

Keywords: Medetomidine, physiological effects, cattle calves.

INTRODUCTION

Sedative drugs have a major role in medical, surgical and diagnostic procedures. They relieve anxiety and facilitate restraining of the patient for minor surgical procedures under local anesthesia and are also used as a preanesthetic medication (Hall *et al*, 2003). Chemical immobilization is one the most important method of capturing of free range and vicious cattle. Among the list of different drugs used for this purpose, Xylazine is one of the commonly used drug. But despite of its frequent use this drug is not very safe and potent for immobilization of cattle and other animals (Thurmon and Benson, 1993). In recent era medetomidine is more potent and safest alpha 2 adrenoceptor agonist than xylazine for sedative, analgesic and for immobilization of cattle and other wild and as well as for farm animals (Muge *et al*., 1994). Study on different parameter of medetomidine shows that it is 10 to 20 times more potent and safe than xylazine (Hall and Clarke, 2003).

Medetomidine is the newest α_2-agonist approved for veterinary use. It is a lipophilic molecule, which is rapidly eliminated from the body. Its potency and efficacy is greater than the other α_2-agonist because of its selectivity-binding ratio for alpha^2/alpha^1-receptor, which is 1620 in comparison to detomidine, clonidine and xylazine, which is 260, 220 and 160 respectively. Medetomidine produces potent and safest degree of sedation analgesia and muscle relaxation (Lumb and Jones 1996). The solution of drug is non-irritant and can be used safely through different rout like IV, IM and by SC injection. Intravenous injection gives the fastest and most reliable results (Hall *et al*., 1991). Mostly the drug as a sedative has been used in dogs from 5 to 40µg/kg intravenously or intramuscularly (Joubert and Lobetti, 2002: Mckelvey and Hollingsshed., 2003) while the doses in goats are 4 to 20µg/kg I/V (Caroll *et al*., 2005: Memon., 1999: Raekallio, 1998), in horses 1.25µg/kg/ hours I/V (Muhammad, 1993), in sheep 6-10µg/kg I/V (Kak., 2007; Malhi, 2006), buffaloes 5-10µg/kg I/V (Shahani, 1998) and in cattle 10-20µg/kg I/V (Hall *et al*., 2003).

Common side effects encountered with medetomidine in dogs are the vomiting, muscular twitching and hyperthermia, in goats are CNS depression, head dropping and ataxia (Muhammad, 1993) and in buffalo calves are respiratory depression, bradycardia, hypothermia and hyperglycemia (Shahani, 1998). A marked salivation, hyperglycemia and polyuria were also observed in cows (Lin *et al*., 1998; Ranheim, 1999). So this drug is strongly prohibited in those animals having cardiac disease, respiratory disease, liver dysfunctions, kidneys problems, hyperglycemic and severely debilitated. Medetomidine is commonly used as sedative but is also used as a preanesthetic prior to ketamine, barbiturate, or mask induction with an inhalation anesthetic (Lumb and Jones, 1996). Combinations with ketamine are more effective than the sedative alone (Hall and Clarke, 2003).

Medetomidine basically is a drug that is used as a common sedative for dogs. However, it has been now

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extensively used in other animal's species. Various studies have been done by different researchers on the sedative, analgesic and some other physiological effects of medetomidine in equine (Bryant *et al.,* 2004; Muhammad *et al*., 2006), in cattle (Arnemo and Soli, 2005), sheep (Muhammad *et al.,* 1993; Malhi, 2006; Kaka, 2007), goats (Muhammad *et al*., 1989; Memon, 1999; Carroll *et al.,* 2005), cats (Golden *et al*., 1996), rabbits (Mangi, 2004), ferrets (Ko and Jones, 1996), buffalo calves (Shahani 1998; Kalhoro *et al.,* 2000) and in elephants (Sharma *et al.,* 2002). However no comprehensive work has been done on the use of medetomidine in Red Sindhi cattle calves (Raekallio *et al.,* 1991; Rioja *et al*., 2008). So this study is planned with two objectives. One was to study sedative effects of medetomidine and 2nd objective was on find out the effect of medetomidine on serum glucose level of Red Sindhi cattle calves.

MATERIALS AND METHODS

Animals

Red Sindhi Cattle calves (n=6) with an average age 8.16 months and weight 56.16kg were acclimatized by keeping them at livestock farm for two weeks where they were dewormed and vaccinated. Experimental animals were tagged from numbers 1 to 6. The three doses i.e. 8, 10 and 12µg/kg of medetomidine was used. Drug dose were calculated according to body weight and administered intravenously with on week interval to each animal. Before and after administration of medetomidine the following parameter were recorded with time intervals.

Determination of serum glucose level by spectrophotometer

Blood samples from each animal were collected before administration of medetomidine as control and at 0.5, 01, 1.5, 02 and 24hrs after administration of the medetomidine. The sample was centrifuged at 4000 rpm for 5 minutes to isolate the serum. Serum glucose level was determined with the help of U-1800 spectrophotometer (Hitachi, Japan) by using the enzymatic colorimetric test without Depolarization. (Glucose Liquicolor GOD-PAP Method kit, Human, Germany)

Sedative effects

The onset, optimal and total duration of sedation were recorded in each animal after every treatment

STATISTICAL ANALYSIS

The data was collected and analyzed through ANOVA and further comparisons were made through DMRT (Duncan Multiple Range Test).

RESULTS

Serum glucose

The mean level of serum glucose was increased significantly ($P<0.01$) with all three doses of medetomidine used in cattle calves in this study (table 1). Maximum increase was observed with higher doses of medetomidine. The serum glucose level was on peak after 0.5hr. of administration which was gradually decreased later on and at 24 hrs it had returned to the base line (table 1). Physiological effects were studied with different doses of medetomidine under same experimental conditions in cattle calves.

Onset of optimal sedation, Duration of optimal sedation and total time of sedation

The mean values for onset of optimal sedation in cattle calves were 5.75±0.33, 3.66±0.16 and 2.08±0.20 minutes after administration of 8, 10 and 12µg/kg of medetomidine respectively this show a significantly different ($P<0.01$) and dose dependent sedative effect of this drug in Red Sindhi Cattle Calves (Table-2). Moreover the mean values for duration of optimal sedation in cattle calves were 46.83±2.00, 60.83±3.60 and 97.00±0.57 minutes after administration of 8, 10 and 12µg/kg of medetomidine respectively, which were again significantly ($P<0.01$) different and dose depended effect. Similarly mean values for total duration of sedation were 73.83±0.69, 96.70±0.71 and 117.20±0.60 minutes after medetomidine administration at different dose rate (8, 10 and 12µg/kg respectively), which were significantly different ($P<0.01$) between the treatment groups (table-2).

DISCUSSION

This study was design to study sedative effect of medetomidine in Red Sindhi cattle calves, and to study effect of this drug on serum glucose level of Red Sindhi cattle calves in three different doses. In the present study there was a significant ($P<0.01$) and dose dependent increase in serum glucose level after administration of different doses of medetomidine with a maximum increase observed after 30 minutes of medetomidine administration. Other researchers also reported the same trend in increase in serum glucose. It was observed that there is significant increase in the serum glucose level after administration of medetomidine and which were came to normal after complete recovery from sedation in cows (Ranheim, 1999; Amemo and Soli 1991), study in buffalo calves shows the same result on serum glucose level when the animals were examined under the sedation due to medetomidine (Shahani, 1998; Kalhorroo, 2000) and similar observation on serum glucose level was observed by different researcher from different corners of the world in goats (Caroll *et al*., 2005; Memon., 1999; Raekallio 1998; Shah 2008).

Table 1: Mean blood glucose level (mg/dl) after administration of medetomidine.

Time (hrs)	8µg/kg	10µg/kg	12µg/kg
0	92.7±0.14	92.4±0.15	92.1±0.16
0.5	132.6±0.35** ++ ΔΔ	140.3±0.22 ** ++ rr	143.9±0.37** ΔΔ rr
01	128.4±0.31 ** ++ ΔΔ	128.9±0.63 ** ++ rr	132.3±0.43 ** ΔΔ rr
1.5	111.6±0.24 ** ++ ΔΔ	114.1±0.25 ** ++ rr	116.5±0.23 ** ΔΔ rr
02	94.8±0.11 ** ++ ΔΔ	96.9±0.25 ** ++ rr	99.6±0.39 ** ΔΔ rr
24	92.4±0.24	92.6±0.27	92.8±0.18

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

Table 2: Onset of optimal sedation, duration of optimal sedation and total duration of sedation at different doses of medetomidine

S. No		Dose (µg/kg)		
		8	10	12
01	On set of Optimal Sedation (mins)	5.75±0.33 ++ rr	3.66±0.16 ++**	2.08±0.20 rr **
02	Duration of Optimal Sedation (mins)	46.83±2.00 ++ rr	60.83±3.60 ++**	97.00±0.57 rr **
03	Total Duration of Sedation (mins)	73.83±0.69 ++ rr	96.70±0.71 ++ **	117.20±0.60 rr**

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

All the parameter in the conducted study showed dose dependent effect, mean increase in the dose, effect will be increase and vice versa i.e. quick onset and long lasted sedation with higher doses (12µg/kg) as compared to lower doses (8µg/kg) of medetomidine. Most of the findings of current the study shows similar findings reported in cattle by (Abass *et al*., 2005; Waldridge *et al*., 1997), same dose dependent results was observed in buffalo calves (Shahani, 1998), rabbits shows the same results in connection to the current findings (Mangi, 2004), in goats (Shah, 2008) and in sheep (Mlhi, 2006).

Deep sedation was observed at higher doses i.e. 10 and 12 µg/kg and the duration of sedation was longer in case of 12µg/kg while it was shorter in case of 10µg/kg. The finding of this study showed somewhat similarities to other researcher who worked on medetomidine in cattle (Abass, 2005; Waldridge, 1997), in buffalo calves (Shahani, 1998), rabbits (Mangi, 2004), goats (Shah, 2008) and in sheep (Malhi, 2006).

CONCLUSION

This is concluded from the recent study that lower doses cause mild sedation of shorter duration while higher doses cause deep and prolong sedation. The lower doses of medetomidine (8µg/kg) can be used as a sedative for animal restraining, diagnostic purpose and as a preanesthetic with combination of other general anesthetic may be intravenous or inhalant while higher doses of medetomidine (10µg/kg and 12µg/kg) can be used for the conduction of minor surgical procedures like dressing of wound, drainage of abscess, surgical treatment of superficial skin injuries etc.

SUGGESTION

The researcher suggest/recommend that medetomidine can be safely use in cattle without any harm with mention doses.

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