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Clinical and physiological evaluation of induction combinations romifidine guaifenesin ketamine and dexmedetomidine guaifenesin ketamine under isoflurane anesthesia in cattle

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Abstract
The study was carried out to evaluate the feasibility of romifidine and dexmedetomidine sedation for guaifenesin, ketamine-isoflurane general anaesthesia for various surgeries in cattle. The study was carried out in 12 clinical cases of cattle presented to Veterinary Clinical Complex, Veterinary College Bidar for various surgical procedures. The cases were randomly divided into two groups consisting of six cattle in each group. The animals of group I were administered with romifidine (10 µg/kg,IV). The animals of group II were administered with dexmedetomidine hydrochloride (2.5µg/kg, IV) immediately followed by guaifenesin (50 mg/kg, 5% sol). After ten minutes, the anaesthesia was induced by administering ketamine hydrochloride (3 mg/kg, I/V) and maintained with isoflurane (1-2%) in both the groups. Though the induction and recovery were smooth and uneventful in both groups, faster onset of sedation, faster down time to sternal recumbency, early recovery time to regain sternal position and to assume standing position were noticed in cattle premedicated with romifidine than in cattle premedicated with dexmedetomidine for guaifenesin-ketamine-isoflurane general anaesthesia. Physiological and hemodynamic parameters like heart rate, respiratory rate, rectal temperature, mean arterial pressure and hemoglobin oxygen saturation were fluctuated within normal limit. Respiratory depression and bradycardia were more severe in cattle premedicated with romifidine when compared to cattle premedicated with dexmedetomidine. In present study romifidine-guaifenesin-ketamine-isoflurane combination was ideal to perform major surgeries in cattle without any complications.

Keywords: romifidine, dexmedetomidine, isoflurane, anesthesia

Introduction
Cattle being docile animal allow many of the surgical and diagnostic procedures are performed under physical restraint in conjunction with local or regional anaesthesia and with or without sedation. However, the resulting conditions are sub-optimal for a number of situations, where as for complex and prolonged surgical procedures the use of general anaesthesia is desired (Adetunji *et al.*, 1984) [1]. General anaesthesia may be preferred over local analgesia for many surgical interventions, as it provides complete unconsciousness, better insensitivity to pain, good muscle relaxation, freedom from reflex responses and loss of motor ability (Thurmon *et al.*, 1996) [17].

In recent years, intravenous anaesthetics with rapid onset, redistribution and clearance have become available, which creates the possibility of maintaining anaesthesia even in large ruminants using these intravenous agents (Malik *et al.*, 2012) [14]. Moreover, the use of intravenous anaesthetic agents for induction and maintenance of anaesthesia may facilitate endotracheal intubation, oxygen administration or artificial ventilation if it is required. General anaesthesia can be induced either by injectable or by inhalant anaesthetics.

Alpha- 2 -agonists are becoming increasingly popular among veterinarians for inducing sedation as well as analgesia owing to advantages they offer in comparison to local anaesthetics. Alpha-2-adrenoceptor agonists produce sedation, analgesia and muscle relaxation (England *et al.*, 1996) [7]. These agents produce satisfactory sedative effect based on dose administered. Different alpha-2- adrenoceptor agonists *viz.*, xylazine, dexmedetomidine and medetomidine have been used as sedative and analgesic in different species of animals.

Romifidine is a specific and relatively new alpha-2-adrenergic agonist drug that is mostly administered systemically to bring about sedation and analgesia (Kannegieter, 1993) [8]. Romifidine is a potent and selective alpha-2-adrenoceptor agonist that produces similar

cardiorespiratory effects to other drugs of its group. In horses, romifidine produced a longer sedation than xylazine (England and Clark, 1996) [7].

Materials and Methods

The study was carried out in 12 clinical cases of dogs of either sex presented for various surgical procedures at Veterinary Clinical Complex, Veterinary College, Bidar. The dogs were randomly divided into two groups consisting of six dogs in each group. The animals of group I were administered with romifidine (10 µg/kg, IV). The animals of group II were administered with dexmedetomidine hydrochloride (2.5µg/kg, IV) immediately followed by guaifenesin (50 mg/kg, 5% sol). After ten minutes, the anaesthesia was induced by administering ketamine hydrochloride (3 mg/kg, I/V) and maintained with isoflurane (1-2%) in both the groups. Clinical parameters such as, induction time, recovery time, degree of analgesia, pedal and palpebral reflex and muscle relaxation was recorded before premedication (0 minute), 10 minutes after premedication and at 5, 15, 30, 60 and 120 minutes after induction of general anaesthesia. Physiological observations like, Rectal temperature, Heart Rate and Respiratory Rate will be recorded before pre-medication (0 minutes) and 10 minutes after premedication and at, 5, 15, 30, 60 and at 120 minutes interval after induction of general anaesthesia.

Results and Discussion

This study was undertaken to see the sedative effect on clinical and physiological parameters using romifidine at 10 µg/kg body weight given intravenously (group I) and dexmedetomidine hydrochloride at 2.5 µg/kg body weight given intravenously (group II) for guaifenesin-ketamine-isoflurane general anaesthesia in cattle undergoing clinical surgeries. The results of the study were evaluated and discussed under following headings.

Clinical Observations

The onset of sedation was non-significantly quicker with romifidine when compared to dexmedetomidine for guaifenesin-ketamine-isoflurane anaesthesia (Table 1). Clarke and England (1989) [5] and England stated romifidine had sedative and physiological effects which were similar to other alpha-2 adrenoceptor agonists. England *et al.* (1992) [6] observed signs of sedation (head drop and swaying) were less marked with romifidine compared to equipotent xylazine and detomidine in horses while the duration of sedative action was prolonged up to 200 minutes. Down time to assume sternal recumbency after premedication with romifidine (group I) was 2.33±0.28minutes, and with dexmedetomidine (group II) it was 3.09±0.31 minutes before giving ketamine-isoflurane anaesthesia (Table 2). Though early down time is noticed in the present study with both the drugs, the down time was non-significantly earlier in cattle premedicated with romifidine when compared to cattle premedicated with dexmedetomidine. Shekidef (2007) [15] studied the effect of romifidine in buffalo calves and recorded the mean time 3 minutes and down time 6.40 minutes for romifidine. The recovery time to regain sternal recumbency was 14.16 ± 1.12 minutes in cattle of romifidine-guaifenesin- ketamine-isoflurane and 17.50 ± 1.40 minutes in cattle of dexmedetomidine-guaifenesin- ketamine-isoflurane (Table 3). Degree of analgesia was better in group I at 30 minutes when compared with group II. This suggested that romifidine provides better analgesia during guaifenesin-ketamine-isoflurane anaesthesia in cattle.

Amarpal *et al.* (2002) [4] concluded that romifidine at the rate of 50µ/kg could produce moderate to complete analgesia of perineum and flank after subarachnoid administration in lumbosacral space in goats. The reflexes were absent in both the groups at 30 and 60 minutes. At 2 hours, all the reflexes were regained in both the groups. Singh *et al.* (2013b) reported that buffaloes showed complete abolition of palpebral reflex and mild response to corneal reflex after premedication with dexmedetomidine and fentanyl, which was completely abolished after induction of anaesthesia with thiopentone and isoflurane. The degree of salivation was significantly greater in cattle premedicated with romifidine compared to cattle premedicated with dexmedetomidine. Kumar *et al.* (2014) [11] observed mild degree of salivation after administration of ketamine in dexmedetomidine premedicated goats which might be due to delayed effect of α2 agonist, dexmedetomidine or due to decreased swallowing reflex.

Physiological Observations

The heart rate decreased significantly at 10 minutes after premedication in both the groups. The heart rate also decreased significantly from 5 to 30 minutes after induction of anaesthesia with ketamine and maintenance with isoflurane. Although the reduced heart rate started improving from 1 hour, it was still below normal at 2 hours. Lemke (2007) [12] stated decreased heart rate may be due to reflex bradycardia as a result of α2 agonist induced vasoconstriction. Bradycardia was observed after dexmedetomidine administration in goats (Kastner *et al.,* 2005) [9] and dogs (Ahmad *et al.,* 2011). There was a significant respiratory depression at 10 minutes after pre-medication in both the groups. However, after induction of anaesthesia with ketamine and maintenance with isoflurane, the respiratory rate decreased significantly only till 30 minutes.

Singh *et al.* (2003) stated that ketamine is useful in counteracting some of the depressant action of α2 agonists on respiratory rate. The rectal temperature fluctuated within normal physiological limits in both the groups. Venkatgiri *et al,* (2017) [18] opined that rectal temperature fluctuation was within the physiological limit when romifidine was used as premedicant at the rate of 10 µg/kg body weight given intravenously. Lu *et al.* (2013) [13] observed an immediate decrease in rectal temperature following administration of α2-adrenoceptor agonists, possibly due to loss of thermoregulatory control.

The rectal temperature fluctuated within normal physiological limits in both the groups. There was no significant difference between the group I and II. Rectal temperature decreased non-significantly at 10 minutes after premedication and thereafter increased gradually, however, remained just near the base line value throughout the study period of guaifenesin-ketamine-isoflurane anaesthesia in both the groups.

Venkatgiri *et al,* (2017) [18] opined that rectal temperature fluctuation was within the physiological limit when romifidine was used as premedicant at the rate of 10 µg/kg body weight given intravenously. The decreased temperature might also be due to generalized sedation, decreased metabolic rate, muscle relaxation and central nervous system depression (Khattri *et al.*,2013) [10]. Ahmad *et al.* (2011) [2] reported decreased rectal temperature after dexmedetomidine administration in dogs. Singh *et al.* (2013) [16] observed a significant decrease in rectal temperature in buffaloes under

dexmedetomidine-fentanyl-thiopentone-isoflurane anaesthesia. In conclusion Onset of sedation and down time to sternal recumbency were faster in the cattle premedicated with romifidine, as compared to the cattle premedicated with dexmedetomidine for guaifenesin-ketamine-isoflurane induction combination. Recovery time to regain sternal position and to assume standing position were faster in cattle premedicated with romifidine than in cattle premedicated with dexmedetomidine during guaifenesin-ketamine-isoflurane general anaesthesia. Respiratory depression, bradycardia and decrease in mean arterial pressure were more severe in cattle premedicated with romifidine when compared to cattle premedicated with dexmedetomidine during guaifenesin-ketamine-isoflurane anaesthesia. premedication with romifidine (10 µg/kg IV) or dexmedetomidine (2.5 µg/kg, IV) for anaesthetic induction with guaifenesin (50mg/ kg,5% Solution IV),ketamine (3 mg/kg, IV) and maintenance of anaesthesia with isoflurane (1-2%) provided satisfactory surgical plane of anaesthesia in cattle.

Table 1: Mean ± S.E of onset of sedation (minutes) in cattle of group I and II

Parameter	Groups	Mean ± S.E
Onset of sedation	Group I	2.04 ± 0.21
	Group II	3.10 ± 0.42

Table 2: Mean ± S.E of down time to sternal recumbency (minutes) in cattle of group I and II

Parameter	Groups	Mean ± S.E
Down time to sternal recumbency	Group I	2.33 ± 0.28
	Group II	3.09 ± 0.31

Table 3: Mean ± S.E recovery time to sternal position (minutes) in group I and II Cattle

Parameter	Groups	Mean ± S.E
Recovery time to sternal position	Group I	14.16 ± 1.12a
	Group II	17.50 ± 1.40b

Means bearing superscript a, b differs significantly (*P≤0.05*) between the groups at corresponding intervals

Conclusion

The present study showed romifidine-guaifenesin-ketamine-isoflurane combination was ideal to perform major surgeries in cattle without any complications.

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