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Evaluation of Glycopyrrolate, Diazepam - Fentanyl and Xylazine – Pentazocine as Preanaesthetics to Propofol – Isoflurane Anaesthesia in Dogs

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ABSTRACT

The present study was conducted to evaluate and compare four different balanced anaesthetic protocols in clinical cases of dogs undergoing various surgical procedures. In subgroup X1 and X2, glycopyrrolate was administerd followed by xylazine and pentazocine at different doses. In subgroup D1 and D2 diazepam and fentanyl citrate were administered intravenously after 15 minutes of glycopyrrolate administration. After 15 minutes of preanesthetic administration in all groups anaesthesia was induced with propofol was and maintained with isoflurane. The jaw tone was abolished earlier in subgroup X1 in comparison to other subgroups. Abolition of pedal, palpebral, corneal reflexes happened earlier in D2 subgroup in comparison to X1, X2 and D1. Induction dose of propofol was lower in xylazine group than the diazepam group viz. 3.65 ± 0.60 mg/kg in subgroup X1, 4.00 ± 0.30 in subgroup X2 and 6.08±2.03 in subgroup D1, 4.53±0.48 in subgroup D2. Glycopyrrolate caused tachycardia in all subgroup. Alpha2-agonists did not cause bradycardia and diazepam did not alter heart rate and respiratory rate, whereas propofol caused tachycardia and depression in respiratory rate and SPO. Mean arterial pressure (MAP) increased after the administration of glycopyrrolate, xylazine and pentazocine in subgroup X1 while it slightly decreased in rest of the subgroups. It was concluded that Preanaesthetic combination of glycopyrrolate (0.005 mg/kg)-xylazine (0.5 mg/kg)-pentazocine (2 mg/kg) was found best among four combinations.

HIGHLIGHTS

- An intramuscular anesthetic protocol containing glycopyrrolate (0.005 mg/kg), xylazine (0.5 mg/kg), and pentazocine (2 mg/kg) is recommended.
- An intravenous preanaesthetic protocol using glycopyrrolate (0.005 mg/kg), diazepam (1 mg/kg), and fentanyl (5 µg/kg) is recommended for calm and cooperative animals.

Keywords: Dogs, Fentanyl, Glycopyrrolate, Isoflurane, Pentazocine, Propofol

Anticholinergics like glycopyrrolate are given to reduce general anesthesia's induced bradycardia along with the reduction of gastro-intestinal tract motility and respiratory secretions (Potliya *et al*., 2015). Diazepam is a benzodiazepine, and it primarily works as a muscle relaxant, sedative, hypnotic, and anticonvulsant and also reduces the dose of propofol for induction (Robinson and Weir, 2013). Alpha-2adrenoreceptor agonists (α2 -agonists) like xylazine have several characteristics like sedation, anxiolysis, analgesia, prevention of the autonomic reflex response, reduced anesthetic requirements, improved intraoperative stability, and facilitation of induction of the anesthesia.

Both fentanyl citrate and pentazocine are synthetic opioids. Fentanyl is a potent µ opioid receptor agonist and is used as a part of balanced anesthesia in dogs for its excellent analgesic properties (Kukanich and Clark,

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2012). Pentazocine is a benzomorphan derivative that acts as an agonist at the Kappa opioid receptor as well as a mild antagonist or partial agonist at theμ opioid receptor. It has been used as an analgesic with minimal cardiorespiratory effects and has also been helpful in reducing the induction dose of propofol (Anandmay *et al*., 2016).

Propofol (2,6-di-isopropylphenol) is a non-barbiturate ultra-short acting anaesthetic with an alkyl phenyl derivative. It causes rapid central nervous system depression, allowing for anaesthetic induction 20-30 seconds after intravenous administration begins (Robinson and Weir, 2013). Isoflurane is an inhalant anesthetic that has no harmful effect on renal, hepatic, or cardiac functions in dogs during maintenance of anesthesia (Altug *et al*., 2009).

In India, the dog population as companion animals is increasing steadily, and thereby, there is also an increase in the presentation of surgical conditions affecting them, so a quest for the selection of an improved anesthetic protocol is still on. The objectives of the present study were to evaluate and compare two different preanaesthetic combinations, viz., glycopyrrolate-diazepam–fentanyl and glycopyrrolate–xylazine–pentazocine, in different dose rates for propofol–isoflurane anesthesia in dogs on the basis of clinicophysiological and haemodynamic observations and to recommend the best-balanced anesthetic protocol for routine surgical procedures in dogs.

MATERIALS AND METHODS

Sixteen client-owned dogs of different breeds of either sex and of different age groups (4 months to 11 years) suffering from various surgical affections were selected as the subject of the study. They were divided into four groups, viz., X1, X2, D1, and D2 (Table 1). Fifteen minutes after intramuscular administration of glycopyrrolate (0.005 mg/kg), other preanesthetics were intramuscularly injected separately as shown in Table 1. In all four groups, anesthesia was induced after 15 minutes of preanesthetic administration. Anesthesia was induced with intravenous propofol (2-6 mg/kg) "till effect" and maintained with isoflurane using a small animal anesthesia machine in a semi-closed circle system, keeping the vaporizer setting between 1-3% depending on the requirement as evidenced by the status of different reflexes and the pain response shown by the animal. The anesthesia was maintained for 60 minutes, or until the surgical procedure was completed and the following parameters were observed.

Clinical parameters

The baseline values of all clinical parameters, viz., the status of various reflexes, were recorded before administration of the preanesthetic at 0 minutes and then at 5, 10, 20, 30, 40, 50, and 60 minutes of anaesthesia or till the end of the observation period. The examiner for the subjective determination of scores for various reflexes and jaw tone was not blinded but was the same person during each trial throughout the period of study.

Reflexes

The corneal reflex was evaluated by observing the blink of the eyelids when a normal saline-soaked clean cotton strand was placed on the cornea. The palpebral reflex was assessed by observing a blink of the eyelids when touching the area around the medial canthus of the eyes with the index finger. The pedal reflex was assessed by observing the extension movement of the limb when interdigital skin was pinched with an artery forceps. The status of different reflexes was graded on a 0–3 scoring scale as follows: 0 - Absent reflex; 1 - Sluggish reflex; 2 - Moderate reflex; 3 - No change in reflexes.

Jaw tone

Relaxation of the jaw was taken as a measure of muscle relaxation during the study. It was evaluated by observing the resistance to opening of the jaws while pulling the jaws apart. The status of jaw tone was graded on a 0-3 scoring scale as follows:0 - Absence of jaw tone; 1 - Sluggish tone; 2 - Moderate tone; 3 - Normal tone.

Physiological parameters

The baseline values of all physiological parameters, viz., heart rate, respiratory rate, and rectal temperature, were recorded before administration of the preanesthetic once at 0 minutes, then at 5, 10, 20, 30, 40, 50, and 60 minutes, or until the end of the observation period.

Table 1: Different drug-dose combinations used for general anaesthesia in different groups

Groups	Preanaesthetics	Induction agent	Maintenance agent
X1 (n=4)	Glycopyrrolate (0.005 mg/kg, I/M) + Xylazine (0.5 mg/kg, I/M) + Pentazocine (2 mg/kg, I/M)	Propofol (2- 6 mg/kg) "till effect"	Isoflurane (1-3%)
X2 (n=4)	Glycopyrrolate (0.005 mg/kg, I/M) + Xylazine (1 mg/kg, I/M) + Pentazocine (1 mg/kg, I/M)	Propofol (2- 6 mg/kg) "till effect"	Isoflurane (1-3%)
D1 (n=4)	Glycopyrrolate (0.005 mg/kg, I/M) + Diazepam (0.5 mg/kg, I/V) + Fentanyl (10 µg/kg, I/V)	Propofol (2- 6 mg/kg) "till effect"	Isoflurane (1-3%)
D2 (n=4)	Glycopyrrolate (0.005 mg/kg, I/M) + Diazepam (1 mg/kg, I/M) + Fentanyl (5 µg/kg, I/M)	Propofol (2- 6 mg/kg) "till effect"	Isoflurane (1-3%)

Haemodynamic parameters

The hemodynamic status of the animal was assessed by recording the mean arterial pressure (MAP) and oxygen saturation (SPO_2 %). These parameters were recorded by a non-invasive blood pressure monitor and pulse oximeter before administration of any drug (0 minute) and then after 5, 100, 20, 30, 40, 50, 6,s or till the end of the observation period.

Quality parameters

Sedation quality

It was graded on a scoring scale of 0-4, where 0 represents unacceptable sedation, 1 represents vocalization, restlessness, paddling, and lying uncomfortably, 2 represents recumbency, panting, shaking, and agitation, 3 represents quiet recumbency, panting, and trembling, and 4 represents gradual, smooth, quiet recumbency.

Induction quality

It was scored from 0 to 4, with 0 representing unacceptable induction, 1 representing opisthotonos, shaking, vocalization, difficult intubation, 2 representing muscular rigidity, trembling or shaking, delayed intubation, 3 representing smooth, some shaking or trembling, rapid intubation, and 4 representing smooth, quiet, predictable, rapid induction, and easy to intubate.

Recovery quality

It was graded on a scoring scale of 0-4, where 0 represents unacceptable recovery, 1 represents vocalization, restlessness, being able to stand but reluctant to walk, urination and/or defecation, 2 represents being able to stand and walk, agitation, drowsiness, depression, being responsive but slow to react, 3 represents gradual, slow, moderate restlessness, and 4 represents gradual, smooth, quiet, rapid, comfortable recovery.

Analgesia quality

It was graded on a scoring scale of 0–4, where 0 represents unacceptable analgesia, 1 represents full responsiveness towards surgical stimuli, 2 represents some shaking or trembling, crying, and a highly increased respiratory rate, 3 represents a slight increase in respiratory rate, and 4 represents the complete absence of any response towards surgical stimuli.

Duration parameters

Induction time

The time (min) elapsed between the administration of propofol and the effect of induction was noted as the induction time.

Sternal recumbency time

The time of sternal recumbency was measured as the time (in minutes) that elapsed between the discontinuation of isoflurane and the animal regaining sternal recumbency.

Standing time

The time of standing position was recorded as the period of time (in minutes) between the discontinuation of isoflurane and when the animal stood unassisted.

Dose paramaeters

The total dose of propofol (mg/kg) required for induction of anesthesia was calculated for each animal, and the required concentration of isoflurane (% range) for maintenance of anesthesia was also recorded.

STATISTICAL ANALYSIS

The descriptive statistics were calculated group-wise for different parameters. The results were tabulated as the mean ± standard error of the mean (SE). An analysis of variance was applied to find significant differences among four groups. A post hoc test (Duncan multiple new range test, DMRT) was applied to evaluate pair-wise differences.

Parameters studied over time intervals were tested using the paired't' test. The mean difference at different time intervals was tested with reference to values at "0" min. The results were considered significant at $P \leq 0.05$ and highly significant at $P \leq 0.01$.

RESULTS AND DISCUSSION

Clinical parameters

Corneal reflex

The status of the corneal reflex is used to determine the degree of central nervous system depression. In the present study, an abolished reflex was observed from a 40- to a 60-min time interval of the observation period in animals of all four groups except group D1.

Jena *et al*. (2014) observed that corneal reflex scores fell non-significantly ($P>0.05$) from 10 to 60 minutes in dogs administered with xylazine (0.5 mg/kg body weight IV) and 75 minutes after propofol (IV bolus until induction). These findings are similar to the findings of the present study, as the reflex was abolished only after the induction of general anesthesia.

Palpebral reflex

The status of the palpebral reflex is considered a measure of the depth of sedation. An abolished reflex was observed from a 40- to a 60-min time interval of the observation period in animals of all four groups except group D1.

Tyagi *et al*. (2010) observed that the palpebral reflex was abolished completely after induction of anesthesia with propofol suggesting that the animal is in the surgical stage of anesthesia. Jena *et al*. (2014) also reported that the scores of the status of palpebral reflexes decreased after xylazine or dexmedetomidine and propofol administration. In the present study, between 40 and 60 minute time intervals, the animals of groups X1, X2, and D2 showed higher depression of the palpebral reflex in comparison to that of group D1, which might be due to the fact that diazepam was used at a lower dose in group D1 and also that xylazine is a more potent sedative used in group X than diazepam, which is used in group D (Kim *et al*., 2000).

Pedal reflex

The pedal reflex was completely abolished at 30 min in all four groups and remained so till the end of the observation period in groups X1, X2, and D2, while in group D1, it slightly increased at 50-60 min time intervals. During the induction phase of this investigation, all the animals showed an intact but weak to extremely faint response. During maintenance of anaesthesia, some animals in group D1 displayed a sluggish, intermittent pinching of the interdigital skin of the foot pad. The fact that the pedal reflex was not entirely abolished in D1 group animals corroborates the findings of Ko *et al*. (2000).

Status of jaw tone

In the present study, an adequate muscle relaxation, indicated by no resistance to the opening of the jaws, was observed from 30 to 60 minutes of observation in animals of all groups except group D1. Because the ability to fully open the mouth is lost during moderate anesthesia, jaw tone is regarded as a useful anaesthetic indicator (Thurmon and Short, 2007; Hopster *et al*., 2014). A reduction in jaw tone following preanaesthetic administration was observed, and the jaw tone was completely abolished post-induction. These observations were in accordance with the findings observed by Monsang (2011) and Ahmad *et al*. (2013).

Physiological parameters

Heart rate

After 5 minutes of glycopyrrolate administration, the

animals of group D1 experienced a highly significant (P<0.01) increase in heart rate, whereas the animals of groups X1 and D2 had a significant (P<0.05) increase in heart rate in comparison to their baseline values, and the animals of group X2 had a non-significant (P>0.05) increase in heart rate at the same time intervals. In agreement with this, the results of an earlier study also showed that the heart rate increased 5 minutes after the administration of glycopyrrolate. Anticholinergics cause an increase in the heart rate (Shinde *et al*., 2018; Saikia *et al*., 2019).

A significantly (P<0.05) higher decrease in heart rate was observed at 40- and 50-min intervals in groups X1 and D2 than in group X2 and D1. This result is indicative of dose-dependent cardiovascular depression caused byxylazine, pentazocine, fentanyl, propofol, and isoflurane. Similar to the present study in propofol and ketamine-propofol groups, a gradual decrease in heart rate was observed throughout the study period after initial increase, which must be due to the depressant action of propofol on the cardiovascular system (Amengual *et al*., 2013; Thejasree *et al*., 2018; Shinde *et al*., 2018).

Respiratory rate

A comparison among the groups revealed no significant (P>0.05) difference in the values of respiratory rate at any time interval. However, at the 5-minute interval, there was an increase in respiratory rate as compared to base value in all the groups, although the increase was non-significant. Thereafter, a gradual decrease in respiratory rate was observed in all the groups.

In groups D1 and D2, a significant (P<0.05) reduction in respiratory rate was observed at the 20-min interval; after that, respiratory rate remained at a very low level upto 60 min in comparison to other groups at the same intervals. Respiratory depression is one of the central effects of opioids, in addition to analgesia (Kimura *et al*., 2016). Further, this might be due to dose-dependent respiratory depression caused by diazepam and propofol.

Similar to the results of the present study, Lerche (2015) found that post-induction apnea was more common in propofol and ketamine combinations (11 of 15) than propofol alone (6 of 15). However, in the present study, in which post-induction apnea was not commonly encountered after propofol induction in any of the groups.

Rectal temperature

The comparison among the four groups revealed no significant (P>0.05) difference in rectal temperature at any time interval, although a reduction in rectal temperature was seen in all the groups after the 10-min interval, which was continued upto 60 min. A decrease in rectal temperature in all groups might be due to generalized sedation, a decrease in metabolic rate, muscle relaxation, and CNS depression. Alpha-2 adrenoceptor agonists have also been reported to induce prolonged depression of thermoregulation. These agents have also been found to depress the hypothalamic noradrenergic alpha-2 receptors and cause hypothermia (Macdonald *et al*., 1988).

Haemodynamic parameters

Mean arterial pressure

A significant (P<0.05) increase in mean arterial pressure was observed in the animals of group X1 at the 40-min time interval, then it increased non-significantly (P>0.05) upto 50 min and decreased at 60 min, while in group X2, a non-significant (P>0.05) fluctuation in the values of mean arterial pressure was recorded throughout the observation period. In group D1, a non-significant (P>0.05) reduction in mean arterial pressure was seen at the 10-min time interval, then it increased non-significantly (P>0.05) up to 50 min and got reduced at 60 min. In group D2, there was a non-significant increase in mean arterial pressure from 20 to 50 minutes and then it got reduced at 60 minutes. The findings are similar to earlier study wherein a decrease in MAP in groups having diazepam was observed, whereas in xylazine groups MAP increased (Taneyama *et al*., 1993).

Arterial haemoglobin oxygen saturation (SPO_2)

In group X1, the values of SPO_2 remained similar or fluctuated non-significantly (p>0.05) at different time intervals as compared to the base value until the end of the observation period. In group X2, SPO_2 increased non-significantly (P>0.05) from 5 min until the end of the observation period, except for a short period of non-significant (P>0.05) decrease at 60 min. The maintenance of SPO_2 at a higher level throughout the observation time period inspite of the administration of different preanesthetic, induction, and maintenance agents might

be due to the continuous supply of 100% oxygen along with isoflurane.

Munif *et al*. (2020) reported a significant decrease in the values of SPO_2 after administration of xylazine-thiopentone and xylazine-ketamine combinations throughout the observation period; which returned to initial value after complete recovery. The lower value of SPO_2 in their study might be due to the lack of oxygen as the anesthesia was maintained by intravenous drugs only.Similarly, in another study in dogs, diazepam (0.5 mg/kg, IV) followed by propofol (5 mg/kg, IV) produced a significant decrease in SPO_2 values immediately after anesthesia induction which did not return to preanaesthesia levels at any of the subsequent measurements (Calcaterra and Barrow, 2014). In another comparative study conducted by Guzel *et al*. (2013) in aged dogs (10 years or more) the oxygen saturation ratio dropped immediately after anesthesia induction and did not return to preanesthesia levels in any subsequent examinations, which must be due to profound respiratory depressant effect of diazepam-propofol combination, the older age of the animals and non-availability of the oxygen during the anesthetic period.

Quality parameters

Sedation quality

The mean±SE values of scores of sedation quality recorded in the animals of groups X1, X2, D1, and D2 were 3.25 ± 0.25, 3.00 ± 0.41, 2.25 ± 0.25, and 2.75 ± 0.25, respectively. When the sedation quality values of the groups were compared, no significant difference was found. Although the sedation quality score was found highest in group X1, it was followed by X2, D2, and D1, respectively.

Similar to the present study, Hady *et al*. (2017) also reported that after receiving xylazine and ketamine injections, all dogs were deeply sedated, lethargic, and unable to walk. All bodily reflexes were sluggish, and the eyeballs were centrally placed during the premedication and induction stages. Deep anaesthesia was established with extremely good muscular relaxation after propofol administration, which was consistent with the findings of the current study.

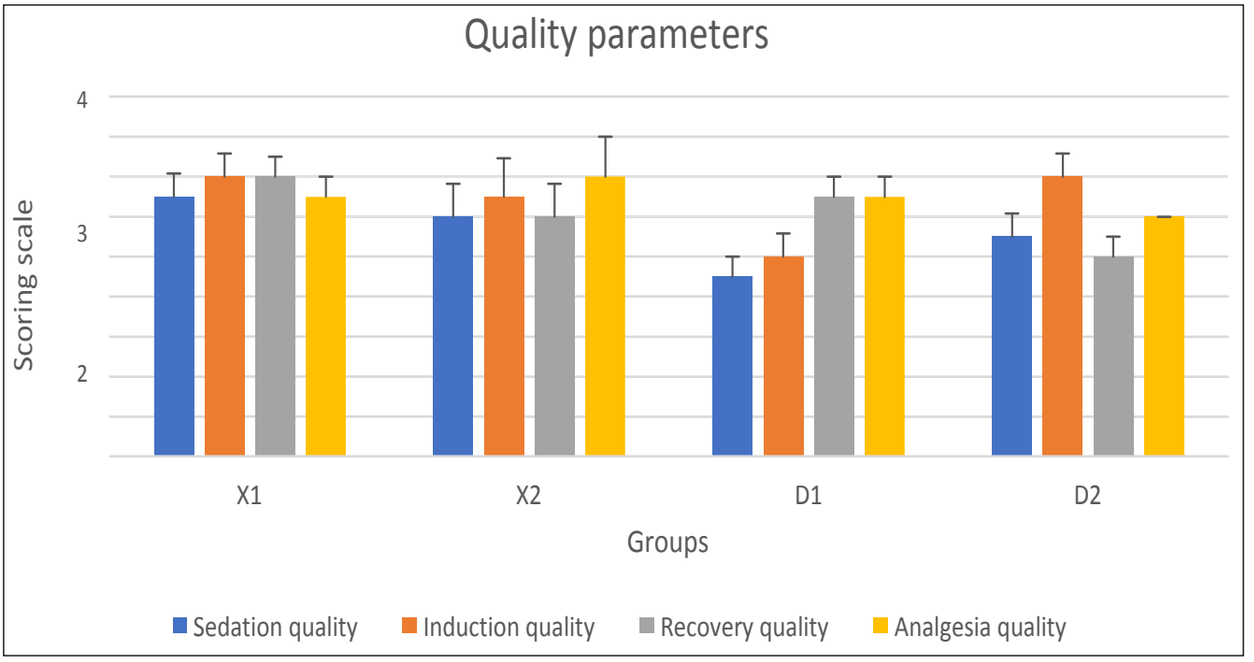

Fig. 1: Mean±SE scores of sedation quality, induction quality, recovery quality, and analgesia quality in the animals of different groups

Induction quality

It was observed that induction quality was found to be highest and equal in groups X1 and D2, followed by X2 and D1 respectively. These findings are comparable to those of Amengual *et al*. (2013), who described rapid anaesthesia induction that allowed easy endotracheal intubation in dogs anaesthetized with propofol at identical doses. Rapid induction can happen 20-30 seconds after starting intravenous propofol administration, while muscular tone and reflexes are lost in accordance with the plane or stage of anaesthetic classification given by Tranquilli *et al*. (2007); Hillman *et al*. (2009), and Vijay *et al*. (2018). Propofol avoids the early phases of anaesthesia depth, which are frequently linked with involuntary colonic movements, making routine excitement-free anaesthetic inductions possible in up to 92.5 percent of instances (Tranquilli *et al*., 2007). Similar findings have been recorded in the present study as well.

Recovery quality

The mean±SE values of the quality of recovery scores in X1, X2, D1, and D2 groups were 3.50 ± 0.29, 3.00 ± 0.41, 3.25 ± 0.25 and 2.50 ± 0.29, respectively. However, no significant ($P<0.05$) difference was observed in the values of the recovery quality among the different groups, although it was observed that the scores of groups X1 and X2 were found to be higher than those of groups D1 and D2. The reason for the high recovery quality score of the xylazine group might lie in the fact that xylazine is a better analgesic than diazepam, so it led to a smooth recovery (Gebremedhin, 2018).

Analgesia quality

When groups were compared among themselves, no significant difference was noted in the values of analgesia quality although it was found to be highest in group X2, followed by X1, D1, and D2, respectively.

In the present study, overall analgesia quality was better in the xylazine group than the diazepam group, and this might be due to the administration of two potential analgesics (xylazine and pentazocine) in group X while only one analgesic (fentanyl citrate) was administered in group D (Hady *et al*., 2017, Dinesh *et al*., 2019; Jena *et al*., 2014).

Duration parameters

Induction time

The mean±SE values of the induction times (min) recorded in the animals of groups X1, X2, D1, and D2 were 1.13±0.13, 2.13±0.13, 1.63±0.24, and 2.25±0.14 minutes, respectively. Comparison among different groups revealed that induction times in the animals of group X2 and D2 were significantly ($P<0.05$) higher than those of groups X1 and D1, whereas induction times between groups X1 and D1 did not differ significantly.

According to Anandmay *et al*. (2016), groups that received premedicants before propofol anesthesia had a shorter mean induction time when compared to propofol alone. Propofol produces effective general anesthesia in different domestic animals either alone or in combination with xylazine (Zama *et al*., 2003; Rana *et al*., 2018). The anaesthetic protocol of propofol as an induction agent induced good-quality anesthesia with a short duration of action in dogs (Alkattan and Helal, 2013; Rana *et al*., 2018).

Sternal recumbency time

The mean±SE values of sternal recumbency time in the animals of X1, X2, D1 and D2 groups were 25.75 ± 6.46, 35 ± 5.58, 24 ± 7.56 and 43.5 ± 3.12 min, respectively. The animals of group D2 took the most time to regain sternal recumbency, followed by those of groups X2, X1, and D1, respectively. However, no significant ($P<0.05$) difference was observed in the values of sternal recumbency time on comparison among different groups.

Standing time

The Mean±SE values of standing time in X1, X2, D1 and D2 groups were 34.75± 8.29, 50 ± 10.62, 31.75 ± 9.83, and 52.25 ± 5.25 min, respectively. Similar to the sternal recumbency time, the animals of group D2 resumed standing position after the longest time, followed by those of groups X2, X1, and D1, respectively. However, no significant ($P<0.05$) difference in standing position time values was observed when comparing the different groups.

The animals in groups X2 and D2 took a non-significantly longer time to show the first spontaneous movement of

any body part than the animals in groups X1 and D1. Tsai *et al*. (2007) reported that the time of the first spontaneous movement of any body part was 1.87 ± 2.53 min in the isoflurane group, while it was 6.14 ± 5.98 min in the propofol-TIVA group. Propofol TIVA provided a slower but smoother recovery as compared with propofol-induced, isoflurane-maintained anaesthesia in dogs. In the present study also, the recovery was smoother and quicker in all the groups as the anaesthesia was maintained with isoflurane in all the groups. Relatively more time was taken by the animals of the X2 and D2 groups, which might be due to the higher doses of sedatives used in these groups, as also evident in higher sternal recovery and standing time.

When comparison was made among the groups for the time of reappearance of the corneal, palpebral, and pedal reflexes, it was found to be lowest in group D1, followed by X1, X2, and D2, respectively. However, no statistically significant (P 0.05) difference in the time of reappearance of the pedal reflex was found between the groups. According to Vijay *et al*. (2018), total recovery time increased with the number of drugs used and was linked to greater drowsiness and a lower metabolic rate due to the drugs' synergistic interactions. This statement backs up the findings of the current study. Early recovery after isoflurane anesthesia could possibly be related to its improved cardiovascular function, lower stress response, and less change in hepatic blood flow with faster clearance.

Tsai *et al*. (2007) reported that animals maintained on isoflurane took less time to regain standing position (27.7 17.2 min) than propofol (34.5 19.34 min). Isoflurane is a widely adopted anesthetic agent in both veterinary and human practice. Recovery from isoflurane is generally rapid and smooth, with occasional short periods of excitement and/or disorientation. Propofol has also been shown to provide excitement-free anaesthetic recoveries in dogs after single or multiple bolus injections (Vijay *et al*., 2018). These findings support the results of the present study.

Dose paramaeters

Mean body weight and required doses of induction and maintenance agent

The required doses of propofol (mg/kg) to achieve general anesthesia in the X1, X2, and D1 and D2 groups were 3.65 0.60, 4.00 0.30, 6.08 2.03, and 4.53 0.48, respectively. The anesthesia could be maintained by setting the isoflurane vaporizer between 1–2% in the X1 group, 1–1.5% in the X2 group, 1–3% in the D1 group and 2–2.5% in the D2 group, respectively.

Comparison among all four groups revealed that the induction dose of propofol was non-significantly higher in group D1, followed by D2, X2, and X1. Also, a higher concentration of isofluranewas required for maintenance of anesthesia in group D1. In the present study, additional doses of propofol were given to some animals in group D1, and this might be because of poor induction quality and poor analgesia in the animals in group D1.

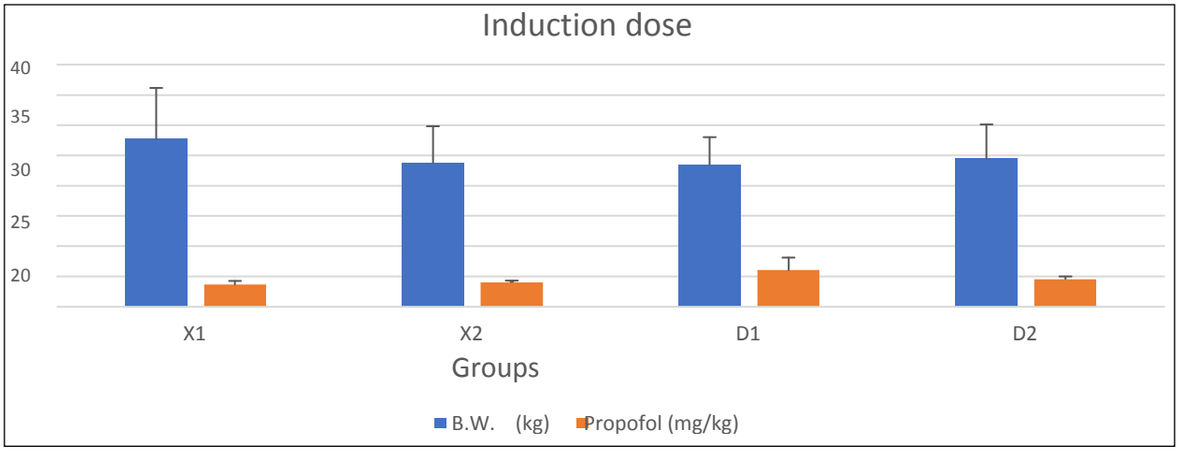

Fig. 2: Mean±SE values of body weight (Kg), induction dose of propofol (mg/kg) in the animals of different groups

Jena *et al*. (2014) reported that after premedication with alpha-2 agonists, the amount of propofol required for induction and maintenance of anaesthesia was significantly reduced. In a similar study, premedication with fentanyl (10 µg/kg) and midazolam (0.2 mg/kg) contributed to a quicker and smoother induction of anaesthesia with sevoflurane (Mutoh, 2007).

The lower vaporizer setting in X1 and X2 groups than in D1 and D2 groups, respectively, suggested a greater minimum alveolar concentration (MAC) sparing effect of xylazine and pentazocine in comparison to diazepam and fentanyl. In other investigations, pentazocine as a preanaesthetic medication allowed for a low induction dose of propofol and a low concentration of isoflurane for the maintenance of general anesthesia (Mutoh *et al*., 2002).

CONCLUSION

The preanaesthetic combination of glycopyrrolate (0.005 mg/kg), xylazine (0.5 mg/kg), and pentazocine (2 mg/kg) was found to be the best among four combinations in terms of the quality of sedation, the quality of induction, the quality of recovery, and the dose-sparing effect of induction and maintenance agents.

For aggressive and uncooperative animals, an intramuscular anesthetic protocol containing glycopyrrolate (0.005 mg/kg), xylazine (0.5 mg/kg), and pentazocine (2 mg/kg) (group X1) is recommended. Whereas, an intravenous preanaesthetic protocol using glycopyrrolate (0.005 mg/kg), diazepam (1 mg/kg), and fentanyl (5 µg/kg) is recommended for calm and cooperative animals.

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