



DEXMEDETOMIDINE VS ACEPROMAZINE AS PRE-ANAESTHETIC AGENTS IN ASA III DOGS: A COMPARATIVE STUDY USING PROPOFOL INDUCTION AND ISOFLURANE MAINTENANCE

Maninderjit Singh*, Vandana Sangwan*, Navdeep Singh, Tarunbir Singh and Jasmeet Singh Khosa

¹*Department of Veterinary Surgery and Radiology, College of Veterinary Science, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana -141 004, Punjab (India)*
*e-mail: maninderjitsinghsaini1999@gmail.com; drvandanasangwan@rediffmail.com

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ABSTRACT

Balanced general anaesthesia is pre-requisite for surgical interventions in dogs. The present study was aimed to compare dexmedetomidine and acepromazine premedication in combination with butorphanol and glycopyrrolate in propofol-anesthetised and isoflurane-maintained ASA III dogs. A randomised clinical study was done on 21 dogs. Group 1 included 9 dogs pre-anesthetised with butorphanol (0.2 mg kg^{-1}) + dexmedetomidine ($10 \text{ } \mu\text{g kg}^{-1}$) + glycopyrrolate (0.01 mg kg^{-1}) combination, while group 2 included 12 dogs pre-anesthetised with butorphanol (0.2 mg kg^{-1}) + acepromazine (0.05 mg kg^{-1}) + glycopyrrolate (0.01 mg kg^{-1}) combination, intramuscularly. Anaesthesia was induced with propofol $2\text{-}4 \text{ mg kg}^{-1}$, intravenous, and was maintained with isoflurane mixed in 100% oxygen. Heart rate, respiration rate, temperature, blood pressure, oxygen supplementation, isoflurane requirement and end tidal CO_2 were noted every 10 min. Post-induction apnoea was common in group 1. The oxygen flow rate and isoflurane requirements were high in group 2 throughout the surgery. Significant bradycardia was recorded after premedication in both the groups, which was more profound in group 1. Group 2 showed tachycardia after induction with propofol. The blood pressure increased significantly post-induction in group 1, while group 2 showed sustained hypotension. The recovery was faster in group 1, although the quality of recovery was similar in both the groups. In conclusions, dexmedetomidine ($10 \text{ } \mu\text{g kg}^{-1}$) produced profound sedation and faster recovery than acepromazine in ASA III dogs. Both the combinations were safe for ASA III dogs however, with prominent cardiovascular effect of drugs recorded in ASA III dogs, a reduction in dose or change in protocol (induction agent) is recommended.

Keywords: Acepromazine, blood pressure, dexmedetomidine, heart rate, isoflurane, premedication, propofol

INTRODUCTION

Most surgical procedures in dogs require general anaesthesia, and a combination of drugs is used to achieve balanced anaesthesia and to fulfil the anaesthetic triad of amnesia, analgesia, and muscle relaxation. Appropriate pre-anaesthetic medication, smooth induction, and stable maintenance are essential for ensuring perioperative safety, particularly in systemically compromised canine patients classified as American Society of Anaesthesiologists (ASA) physical status III. The pre-anaesthetic drugs are mainly used for sedation and anxiolysis, thereby calming the dog prior to induction.

Dexmedetomidine is a strong alpha-2 adrenergic receptor agonist with analgesic effects (Murrell and Hellebrekers, 2005). It induces sleep-like sedation, reduces anxiety, and has sympatholytic and anaesthetic-sparing effects with minimal respiratory effects. It also protects organs from ischaemic and hypoxic injury (Mahmoud and Mason, 2015). It causes bradycardia and transient hypertension immediately after its administration. Acepromazine is a phenothiazine tranquiliser that blocks dopamine receptors in brain and exhibits anti-emetic, anti-convulsion, anti-spasmodic, alpha-1 receptor-mediated hypotension, and hypothermic properties. It induces muscle relaxation without analgesia (Tranquilli *et al.*, 2007). Butorphanol is opioid, which is a kappa agonist and mu antagonist which provides mild sedation through kappa and sigma receptors without causing nausea and subsequent vomiting. It slightly depresses cardiovascular function in dogs (Trimble *et al.*, 2018). Glycopyrrolate is an anticholinergic pre-anaesthetic and is used to prevent reflex bradycardia and bronchial secretions (Gallanosa *et al.*, 2025). Propofol is a short-acting inducing agent that causes apnoea and hypotension and thus produces quick, smooth, and safe unconsciousness (Cattai *et al.*, 2018). Inhalant anaesthesia is commonly used for maintenance as it offers better control over anaesthetic depth and rapid recovery. Isoflurane is a frequently used inhalant in veterinary practice as it offers a stable haemodynamic response, rapid recovery, and minimal hepatic metabolism. It also protects the brain from ischaemia and hypoxia (Otto and Thaden, 2012).

The butorphanol + acepromazine + glycopyrrolate (BAG) and butorphanol + dexmedetomidine + glycopyrrolate (BDG) protocols are commonly used as premedication in dogs (Talekar *et al.*, 2022). Previous studies have demonstrated that acepromazine and dexmedetomidine differ markedly in their cardiovascular and hemodynamic effects when used as pre-anaesthetics in isoflurane-anesthetized dogs (Grasso *et al.*, 2015), and their use has been associated with variable incidences of hypotension and bradycardia in clinical settings (Martin-Flores *et al.*, 2019). Furthermore, induction agents such as propofol has been reported to cause post-induction apnea, particularly when combined with sedative pre-anaesthetics including acepromazine or dexmedetomidine (Bigby *et al.*, 2017). Despite these findings, direct comparative information on the overall anaesthetic quality, cardiorespiratory safety, and clinical performance of BAG and BDG protocols under standardized propofol-based anaesthesia remains limited, especially in Indian context. By comparing these two protocols, a safer and more effective pre-anaesthetic with propofol can be chosen for surgical cases of dogs, which may enhance the overall quality of anaesthesia.

The present study was aimed to validate the existing data and refine the assessment of critical clinical parameters for dog as per the American Society of Anaesthesiologists (ASA), and optimise the anaesthetic dose selection tailored to individual physiological profiles. The study also compared BDG and BAG protocols in combination with propofol and isoflurane based on physiological monitoring parameters, ECG and haemato-biochemical tests.

MATERIALS AND METHODS

A randomized clinical study was conducted over a period of one-year (March 2024 to February 2025) after approval by the Committee for Control and Supervision of Experiments on Animals (CPCSEA), New Delhi (vide letter No. V-11011(13)/2/2024-CPCSEA-DAFD). The study included 21 dogs presented to the Department of Veterinary Surgery and Radiology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab for various surgical ailments. The dogs ranged in age from 0.5 to 14 years. Breeds represented in the study included Labrador Retriever (5), mixed-breed dogs (7), Pomeranian (2), American bully (2), Pakistani Bully (1), German Shepherd Dog (1), Boxer (1), Bull Terrier (1), and Himalayan Shepherd (1). All dogs were advised 12 h off feed and 6-8 h off water prior to surgery.

The dogs were classified into ASA III, depending on the procedure/age they underwent. The dogs (N = 21) included in the study were suffering from scrotal (n = 1) or perineal hernia (n = 2), cataract (n = 5), urethrostomy/cystotomy (n = 2), mammary tumours (n = 2), oral growth (n = 2), pyometra (n = 1) and long bone fractures (n = 6) due to accident. The physiological parameters like heart rate, respiration rate, temperature, blood pressure, and mucous membrane, were recorded prior to any premedication administration. Blood samples were drawn prior to preanaesthesia for haemato-biochemical evaluation. Group 1 included 9 dogs pre-anesthetised with butorphanol (0.2 mg kg⁻¹) + dexmedetomidine (10 µg kg⁻¹) + glycopyrrolate (0.01 mg kg⁻¹) combination, and Group 2 included 12 dogs pre-anesthetised with butorphanol (0.2 mg kg⁻¹) + acepromazine (0.05 mg kg⁻¹) + glycopyrrolate (0.01 mg kg⁻¹) combination.

The preanaesthetic combination of 3 drugs in each group was loaded in one syringe and was injected into the lumbar muscles. All physiological parameters were measured 10 min after premedication. After 10 min pre-medication, propofol @ 2-4 mg kg⁻¹ was used for induction, slow intravenous until the palpebral reflex was absent and the eyes rotated ventromedial. The amount of top-up of propofol, if required, was recorded. A suitable-sized endotracheal tube was selected for intubation. The dogs were connected to an inhalant anaesthetic machine using a vapouriser [Meditec PISCES England]. Isoflurane mixed in 100% oxygen was used for maintenance. The dogs were positioned as per the need of surgical procedure.

The dogs were connected to leads of multipara monitors for recording the parameters like heart rate, respiration rate, temperature, blood pressure, SpO₂, EtCO₂, and ECG (3 lead). The mucous membrane colour/time was recorded. The pedal, palpebral, and eyeball positions, degree of muscle relaxation, and jaw tone were manually recorded. All the parameters were recorded at every 10-min interval. The isoflurane was switched off once the last stitch was applied, and the dogs were disconnected from oxygen after 5 min. The endotracheal tubes were deflated, and the dogs were shifted to the recovery room. The physiological parameters during recovery were recorded till dog sits in sternal recumbency or stands. The blood samples were collected and analysed at pre-pre-anaesthetic, after 10 min pre-anaesthetic, during maintenance and after recovery in all the dogs.

All statistical analyses were performed using Microsoft Excel 2021. All parameters were calculated for descriptive statistics of mean and standard error (Snedecor and Cochran, 1994). The data between and within groups at different time intervals was compared using student t-tests. The level of significance was set at $p < 0.05$ or $p < 0.01$.

RESULTS AND DISCUSSION

Induction parameters

The duration of anaesthesia was non-significantly higher in group 1 dogs. None of the dogs in this group required a top-up of anaesthesia, while one dog in group 2 (8.33%) did require so. The jaw tone was relaxed in all the dogs of both the groups. Apnoea after induction was recorded in 88.89% dogs in group 1 and 50% dogs in group 2. The propofol and dexmedetomidine as induction and preanaesthetic agents have a synergistic effect causing respiratory depression; hence, induction apnoea (Stocco *et al.*, 2025).

Maintenance parameters

The isoflurane requirement was significantly higher in group 2 dogs for the first 30 min of anaesthesia than group 1 (Fig. 1). Dexmedetomidine has an isoflurane-sparing effect, thus reducing the dose of maintenance with isoflurane (Aantaa *et al.*, 1997).

Heart rate: The oxygen flow rate was throughout constant in both the groups, whereas a significant drop in heart rate (HR) was observed after pre-anaesthetic administration in both the groups ($p < 0.01$ for group 1 and $p < 0.05$ for group 2) and it was more significant in group 1. and The HR remained

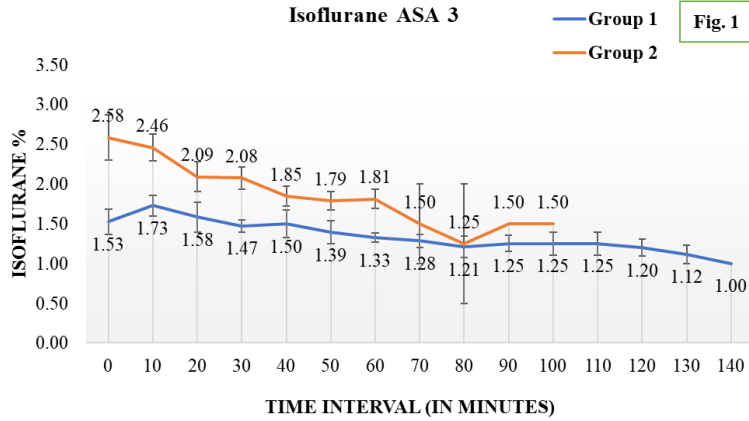


Fig. 1: Mean ± SE of isoflurane values (%) at different time interval in dogs during maintenance phase of anaesthesia

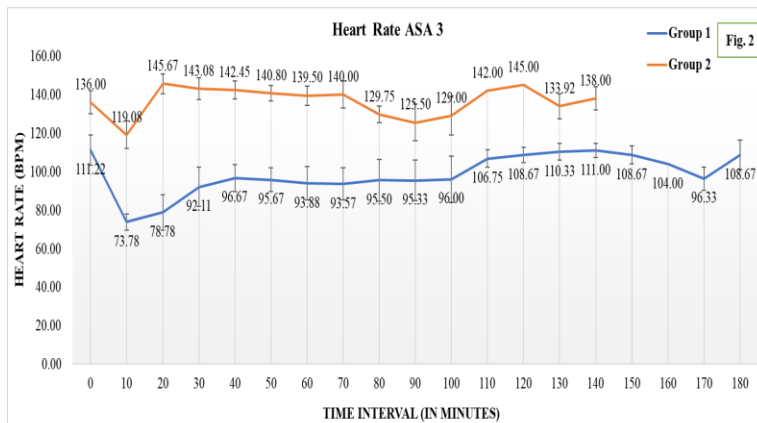


Fig. 2: Mean ± SE of heart rate (beats min⁻¹) at different time intervals in dogs during baseline (0 min), pre-anaesthesia period (10 min), induction phase (20 min), followed by maintenance of anaesthesia, and the final 20-min of recovery phase, recorded at different time intervals in group 1 & 2.

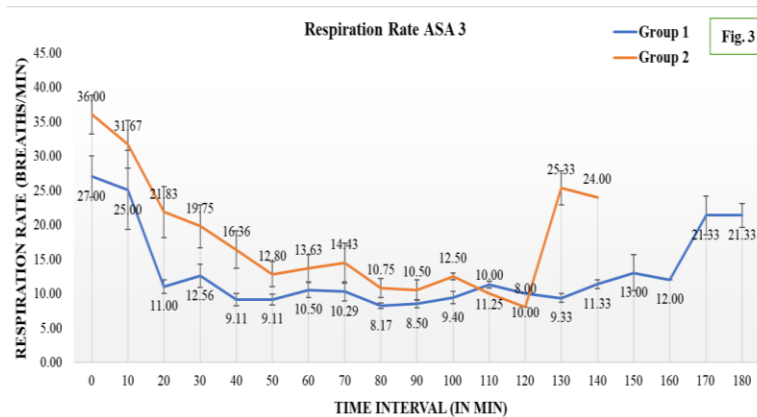


Fig. 3: Mean ± SE of respiration rate (min⁻¹) in dogs during baseline (0 min), pre-anaesthesia period (10 min), induction phase (20 min), followed by maintenance of anaesthesia, and the final 20 min of recovery phase.

less even after induction, and returned to pre-stage at around 130 min of anaesthesia in group 1. In group 2, HR significantly increased ($p < 0.01$) after induction with propofol, remained high up to 70 min of anaesthesia and came back to pre-stage level at recovery. HR was significantly low in group 1 ($p < 0.01$) than in group 2 up to 70 min of anaesthesia, although at presentation also the group 1 HR was significantly ($p < 0.05$) lower than group 2. At recovery, HR returned to normal after 15 min of switching off the isoflurane in group 1; while in group 2 it took less than 5 min (Fig. 2). Dexmedetomidine reduces HR more than acepromazine (Martin-Flores *et al.*, 2019), which is further enhanced in combination with butorphanol (Barletta *et al.*, 2011).

Body temperature: There was no significant change in the rectal temperature of dogs of both the groups. However, a significant drop in temperature was noticed after pre-medication and then further decline during maintenance in group 1. Group 2 showed a non-significant increase after premedication but a significant drop after induction and further during maintenance. The temperature did not return to pre-stage and remained lower even after 156 min in recovery for both the groups. Acepromazine is reported to increase heat loss from the body by causing vasodilation, thereby reducing body temperature (Grasso *et al.*, 2015).

Respiration rate (RR): RR was higher in group 2 right from the beginning, and many dogs of both

both groups were panting at presentation, which might be due to environmental temperature. RR was significantly higher in group 2 at 20, 40, and 100 min of anaesthesia (after induction and during maintenance) in comparison to group 1 (Fig. 3). Within the groups, RR was significantly lower after induction in group 2. Both dexmedetomidine and acepromazine reportedly decreased the respiratory rate due to CNS depressive effects.

Mucous membrane/Capillary refill time (sec): Capillary refill time (CRT) was non-significantly higher in group 2 throughout the anaesthesia in comparison to group 1, but remained constant. During recovery, CRT non-significantly decreased in both the groups.

Eyeball position: The eyeball position remained ventromedial in all the dogs of both groups, with one central in one dog in each group. The eyeball came back to central in 90% dogs in group 2 within 5 min of switching off the isoflurane and in 66% in group 1.

Reflexes: Palpebral reflex was observed in one dog of group 1 and 3 dogs of group 2 at the start of isoflurane, while during maintenance it was absent in all the dogs. The palpebral reflex returned to normal in all the dogs of both groups at 5 min in recovery. Also, there was no pedal reflex in any of the dogs of either group throughout surgery. The pedal reflex came back to normal in 33% dogs in 5 min and all dogs at in min in recovery. Further, jaw tone was absent in all the dogs of both groups throughout anaesthesia.

Peripheral oxygen saturation (SpO₂): Within groups, the SpO₂ reduced more in group 2. Between the groups, group 2 recorded a significantly lower SpO₂ from 20 to 50 min in maintenance (Fig. 4).

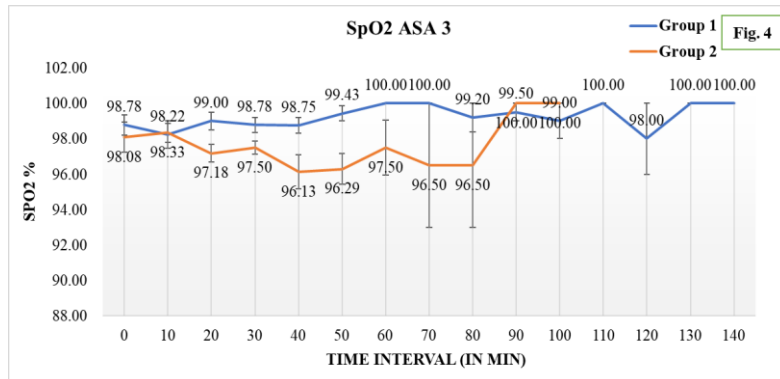


Fig. 4: Mean ± SE of SpO₂ at different time intervals during maintenance phase of anaesthesia

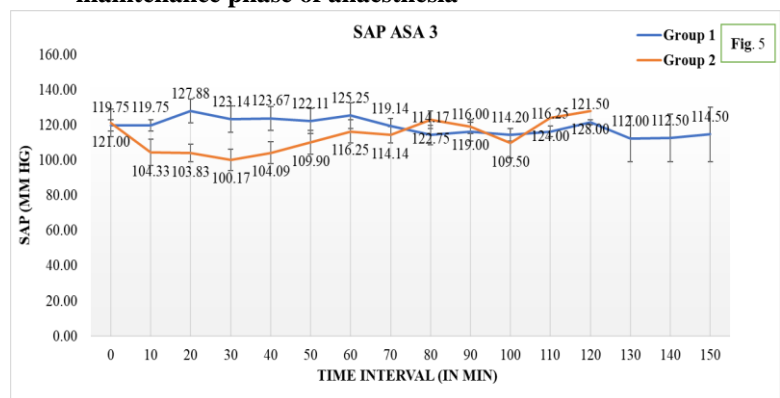


Fig. 5: Mean ± SE of SAP (mm Hg) at different time intervals in dogs during baseline (0 min), pre-anaesthesia period (10 min), induction phase (20 min), followed by maintenance of anaesthesia, and the final 20 min of recovery phase

Blood pressure: Group 1 showed a non-significant increase in systolic arterial pressure (SAP) from 20 min into maintenance in isoflurane, while group 2 showed a non-significant decrease. SAP returned to normal in both groups at 110 min into maintenance. Between the groups, a significantly ($p < 0.05$) lower SAP was observed at 20, 30 and 40 min of maintenance in group 2 (Fig. 5). Dexmedetomidine reportedly causes a transient increase in MAP (mean arterial pressure) and SAP (Pan *et al.*, 2021). The diastolic arterial pressure (DAP) increased in group 1 after 20 min into anaesthesia. However, it decreased in group 2. a significantly lower DAP was recorded at 20, 30, 40 and 70 min of anaesthesia (Fig. 6). Similar to SAP and DAP, the MAP also showed an increase in group 1 during maintenance. However, it decreased in group 2.

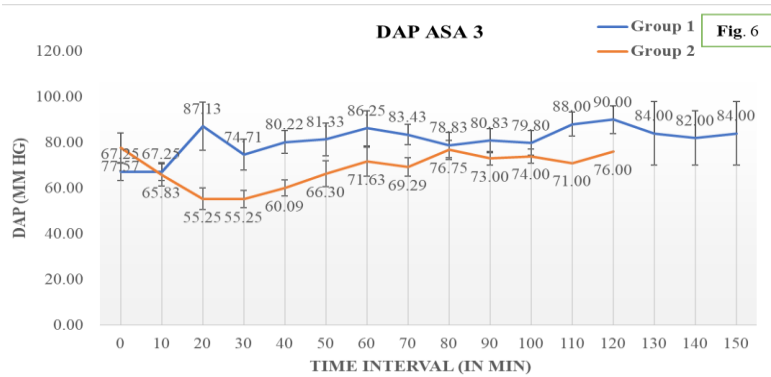


Fig. 6: Mean ± SE of DAP at different time intervals in dogs during baseline (0 min), pre-anaesthesia period (10 min), induction phase (20 min), followed by maintenance of anaesthesia, and the final 20 min of recovery phase

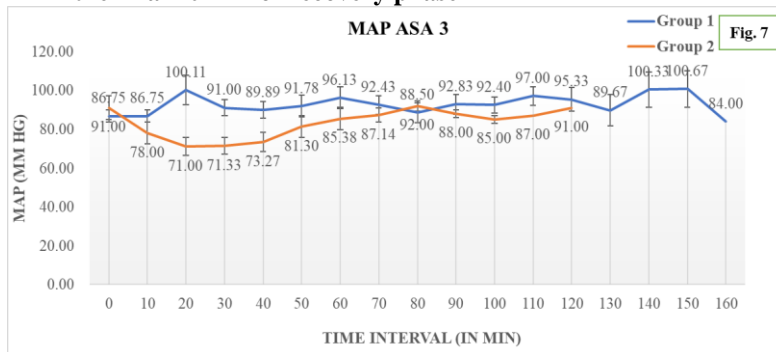


Fig. 7: Mean ± SE of MAP at different time intervals in dogs during baseline (0 min), pre-anaesthesia period (10 min), induction phase (20 min), followed by maintenance of anaesthesia, and the final 20 min of recovery phase

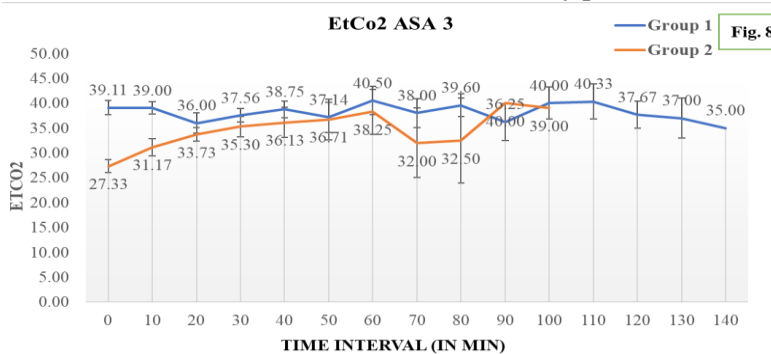


Fig. 8: Mean ± SE of EtCO₂ at different time intervals during maintenance phase of anaesthesia

Between group 2, a significantly lower MAP was recorded at 20, 30, and 40 min of anaesthesia (Fig. 7). Dexmedetomidine is reported to cause a transient increase in MAP and SAP (mean arterial pressure and systolic arterial pressure) (Pan *et al.*, 2021). The acepromazine causes hypotension via alpha-1 receptor-mediated vasodilation in isoflurane anaesthesia dogs. The risk of hypotension in dogs treated with acepromazine was 2.61 times higher than in dogs treated with dexmedetomidine. Dogs given acepromazine experienced hypotension earlier and for a longer period (Martin-Flores *et al.*, 2019).

End tidal carbon dioxide (EtCO₂): Overall, the value of EtCO₂ was lower in group 2 than in group 1; however, the values were within the normal range for both groups. Between the groups, the EtCO₂ was significantly lower in group 2 at the first 10 min of maintenance in comparison to group 1. The post-induction apnoea may cause increased values of EtCO₂ in group 1 (Fig. 8).

Intermittent positive pressure ventilation (IPPV): IPPV was not required in any dog in either group throughout the anaesthesia, except for one dog in group 2 where IPPV was given at the start for post-induction apnoea.

Electrocardiography (ECG): In Group 1, out of 9, 4 dogs (44.44%) showed sinus bradycardia at base, 66.67% (n = 6) after induction and 22.22% (n = 2) during maintenance. In group 2, none of the dogs showed sinus bradycardia at base or after induction or maintenance. However, an inverted T was recorded in 5 dogs (41.67%, 5/12) at base, after induction and during maintenance. One dog each in group 2 showed a peaked T, notched QRS complex and fragmented QRS complex at the base. An inverted T might be due to the normal physiology or various pre-existing cardiac problems in that dog. Artefacts in an ECG might be due to the movement of a pet and improper lead placement during recording.

Haemato-biochemical evaluation: In both groups, a non-significant decline in haemoglobin (Hb) and total leucocyte count (TLC) was observed during the consecutive intervals, with most substantial decrease occurring during maintenance (Table 2). During maintenance and recovery, the Hb values were lower than the normal reference range and were lower than the pre-stage in recovery. The PCV of group 2 was significantly ($p < 0.05$) higher than group 1 before anaesthesia. Similar to Hb and TLC, the packed cell volume and platelets also showed a non-significant decrease after pre-anaesthesia and during maintenance for both the groups and did not return to the pre-stage during recovery.

Table 1: Mean induction parameters in ASA III dogs

	Duration of anesthesia (min)	Top up	Endotracheal tube size (ID, mm)	Jaw tone	Apnea
Group 1 (n = 9)	80.22 ± 13.5	None	8.5 ± 0.34	Relaxed, 100%	1 = 8, 88.89% 0 = 1 dog
Group 2 (n = 12)	48.50 ± 7.09	One dog, 8.33%	9.21 ± 0.29	Relaxed, 100%	1 = 6, 50% 0 = 6, 50%

Apnea present = 1, apnea absent = 0; ID = Internal Diameter

Table 2: The mean haemato-biochemical values for ASA III dogs during pre-pre anaesthetic, after pre-anaesthetic, during maintenance and during recovery

Groups	Pre-pre-anaesthetic	After pre-anaesthetic	During maintenance	During recovery
Haemoglobin (g dL⁻¹)				
Group 1	11.74 ± 0.83	11.24 ± 0.9	8.72 ± 0.46	9.13 ± 0.57
Group 2	13.74 ± 0.67	12.1 ± 0.93	8.64 ± 0.51	8.43 ± 0.6
TLC (x 10³ μL⁻¹)				
Group 1	18.56 ± 2.28	12.95 ± 1.48	9.50 ± 1.18	10.74 ± 1.21
Group 2	1402 ± 1.34	12.26 ± 1.14	9.22 ± 0.79	9.70 ± 9.39
PCV (%)				
Group 1	31.3 ± 1.67*	29.59 ± 2.04	24.11 ± 1.27	25.43 ± 1.35
Group 2	36.78 ± 1.51*	32.08 ± 2.33	24.07 ± 1.2	23.31 ± 1.47
Platelets (x 10³ μL⁻¹)				
Group 1	333.7 ± 33.00	241.89 ± 34.35	236.33 ± 45.02	283.22 ± 41.27
Group 2	275 ± 41.06	233.50 ± 41	195 ± 36.05	195.30 ± 35.32
ALT (U L⁻¹)				
Group 1	30.5 ± 4.5	82.56 ± 43.27	66.33 ± 31.51	79 ± 42.51
Group 2	42.67 ± 7.57	49.17 ± 22.43	41.17 ± 16.62	35.58 ± 13.99
AST (U L⁻¹)				
Group 1	88.00 ± 0.0	76.78 ± 16.97	51.67 ± 10.41	106.89 ± 57.11
Group 2	37.17 ± 6.02	57.17 ± 11.65	45.33 ± 10	38.5 ± 9.23
ALKP (U L⁻¹)				
Group 1	116.5 ± 50.5	160.33 ± 76.24	146.78 ± 55.58	190.44 ± 92.4
Group 2	155.2 ± 63.48	94.5 ± 25.15	91.58 ± 19.04	81.5 ± 21.06
BUN (mg dL⁻¹)				
Group 1	14.71 ± 3.04	10.11 ± 1.18	9.44 ± 0.99	9.44 ± 0.99
Group 2	13.78 ± 2.02	13 ± 3.07	28.17 ± 15.72	11.17 ± 1.41
Creatinine (mg dL⁻¹)				
Group 1	1.05 ± 0.12	0.79 ± 0.07	0.68 ± 0.05*	0.69 ± 0.03
Group 2	1.12 ± 0.11	0.97 ± 0.12	0.94 ± 0.11*	0.84 ± 0.07

*TLC = Total Leucocyte Count; PCV = Packed Cell Volume; ALT = Alanine Transaminase; AST = Aspartate Transaminase; ALKP = Alkaline Phosphatase; BUN = Blood Urea Nitrogen

The alanine transaminase (ALT) showed an increase after pre-anaesthesia in group 1 and later decreased in comparison to pre-anaesthesia. The aspartate transaminase (AST) showed a decrease after pre-anaesthesia and maintenance but an increase in recovery for group 1. The alkaline phosphatase (ALKP) also showed an increase after pre-anaesthesia in group 1 and was in increased range in recovery. However, it decreased in group 2. The ALT and ALKP values increased in group 1 dogs after premedication and further during maintenance, likely due to the pre-existing hepatic condition of the dogs or old age.

The blood urea nitrogen (BUN) values decreased in group 1 during anaesthesia and recovery, while it increased in group 2. However, the values of creatinine decreased in both the groups after pre-anaesthesia and during maintenance and recovery. Though within normal range, the creatinine was significantly higher in group 2 in comparison to group 1 during maintenance of anaesthesia. There was a significantly lower value of creatinine in group 1 as compared to group 2 during maintenance. This may be because of haemodilution, decreased muscle metabolism, or renal hypoperfusion. The altered values of liver enzymes revealed that dexmedetomidine increases liver enzymes while acepromazine lowers them during anaesthesia in ASA 3 dogs.

Recovery parameters

Coughing was observed in 4 dogs (44.44%) in group 1 and 25% (n = 3) in group 2 during recovery. The recovery was faster in group 1 dogs than group 2, with 2 dogs (22.22%) coming in sternal before recovery and 55.55% after recovery. However, in group 2 none of dogs were sternal before recovery, and only 25% became sternal after recovery. Recovery quality was similar in both the groups, although group 2 dogs showed longer extubation time, which could be due to the longer duration of action of acepromazine as compared to dexmedetomidine.

Conclusions: Dexmedetomidine, 10 µg kg⁻¹ produces profound sedation and leads to faster recovery than acepromazine as pre-anaesthetic in ASA III dogs. Both the combinations of dexmedetomidine and acepromazine with butorphanol and glycopyrrolate were safe for ASA III dogs however, with the prominent cardiovascular effect of drugs recorded in ASA III dogs, a reduction in dose or change in protocol (induction agent) is recommended.

Ethical approval: The Institutional Committee for Control and Supervision of Experiments on Animals, New Delhi (India) approved the work vide letter No.: V-11011(13)/2024-CPCSEA-DAFD from for a period of one year.

Conflict of interest: All the authors declare no conflict of interest

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