HAEMATO-BIOCHEMICAL EFFECTS OF GLYCOPYRROLATE, DEXMEDETOMIDINE, FENTANYL BUTORPHANOL AND PROPOFOL-ISOFLURANE ANAESTHESIA IN DOGS

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Two anaesthetic protocols were evaluated in two different age groups (A₁ and A₂: less than 8 years; B₁ and B₂: more than 8 years) of 24 dogs presented for various surgeries. A mixture of glycopyrrolate (0.01mg/kg), dexmedetomidine (5µg/kg) and butorphanol (0.1 mg/kg) was administered intramuscularly in the animals of group A₁ and B₁. In the animals of group A₂ and B₂, a mixture of glycopyrrolate (0.01mg/kg), dexmedetomidine (5µg/kg) and fentanyl (4µg/kg) was administered, intramuscularly. Anaesthesia was induced with 1% propofol (i.v., to effect) and maintained with isoflurane using semiclosed rebreathing system of anaesthesia with a oxygen flow rate of 30 ml/kg/min in all animals. Effect of these combinations on Haemoglobin, PCV, TLC, DLC, blood urea nitrogen, blood glucose and blood creatinine were recorded.

Keywords: Anaesthesia, Butorphanol, Dexmedetomidine, Dogs, Fentanyl, Isoflurane, Propofol.

In dogs and cats, dexmedetomidine produces dose dependent levels of sedation and the intensity of these effects is similar to that produced by twice the dose of medetomidine (Kuusela et al., 2000). Opioids are traditionally included in balanced anaesthesia protocols for their analgesic effects, but they also have sedative effects (Lemke, 2007). Butorphanol a synthetic opioid, is a partial agonist at µ and an agonist at kappa opioid receptors is used in cats, dogs for analgesia and sedative combinations with alpha 2 adrenoceptor agonists (Marini et al., 1992). Fentanyl citrate a synthetic pure µ-opioid receptor agonist with excellent analgesic properties is routinely used as an intravenous infusion due to its rapid onset and short duration of effect (Ilkiw, 1999). Propofol is a nonbarbiturate hypnotic with noncumulative properties and has been used for induction and maintenance of anaesthesia in dogs (Gomez-Villamandos et al., 2006).

Older patients require less injectable and inhalant anaesthetic drugs to produce general anaesthesia as their cardiac reserve is reduced and they are less able to compensate for adverse cardio-vascular events than younger patients (Carpenter et al., 2005). The objective of this study was to compare the haemato-biochemical effects of propofol-isoflurane anaesthesia with two different preanaesthetic combinations in clinical cases of adult, healthy and compromised geriatric canine patients.

Materials and Methods

Twenty four client-owned mixed breed dogs of either sex of different age groups were divided into four groups viz. A₁, A₂, B₁ and B₂ with six animals in each group. A₁ and B₁ group animals of less than eight years of age received a mixture of glycopyrrolate @ 0.01 mg/kg + dexmedetomidine @ 5µg/kg + butorphanol @ 0.1mg/kg, intramuscularly. A₂ and B₂ group animals of more than eight years of age received a mixture of glycopyrrolate @ 0.01 mg/kg + dexmedetomidine @ 5 µg/kg + fentanyl @ 4 µg/kg intramuscularly. In all groups, 15 minutes after administration of preanaesthetics, anaesthesia was induced with propofol (10mg/ml) given slow intravenously, to effect and endotracheal intubation was performed and anaesthesia was maintained with isoflurane using semiclosed rebreathing system with oxygen flow rate of 30 ml/kg/min for at least 60 minutes or until the surgical procedure was completed. Blood samples were collected at time zero i.e.
before administration of preanaesthetics and at 15, 30, 60, 90 and 120 min of anaesthesia for estimation of total leucocyte count (TLC) (×10³/μL), differential leucocyte count (DLC) (%), packed cell volume (PCV) (%), haemoglobin (g/dL), blood glucose (mg/dL), blood urea nitrogen (mg/dL) and blood creatinine (mg/dL) by BC-2800 Vet haematology autoanalyzer and BS-120 Chemistry Analyzer using commercially available Span diagnostic kits. Three ml of blood sample was drawn and one ml of it was transferred to a tube containing EDTA for estimation of haematological parameters and the remaining two ml was kept in dry test tube for separation of serum for estimation of biochemical parameters. Analysis of variance (ANOVA) and Duncan’s multiple range tests (DMRT) was used to compare the means at different intervals among different groups. Paired t-test was used to compare the mean values at different levels with their respective base value in each group.

Results and Discussion

Haemoglobin (Hb) and packed cell volume (PCV) decreased significantly in all groups, till the end of observation period. Decrease in PCV and Hb during the period of anaesthesia might be attributed to the shifting of fluid from extravascular compartment to intravascular compartment in order to maintain normal cardiac output in the animals as also reported by Wagner (1991). A decrease in haemoglobin and PCV may be attributed to pooling of circulatory erythrocytes in the spleen or other reservoirs secondary to decreased sympathetic stimulation or due to haemodilution in response to fluid therapy as also mentioned by Surbhi et al. (2010) and Singh et al. (2013). Naghibi et al. (2002) reasoned that vasodilation at the level of microcirculation and passage of many red blood cells (RBC’s) from circulation may cause decrease in Hb level measured in peripheral veins, which is also called as plasma skimming. The values of PCV may be influenced by haemodilution in response to fluid therapy or vasodilation, resulting in decreased values and haemo-concentration due to dehydration and hypoxia results in higher values as also opined by Malik and Singh (2007). In present study, decrease in total leucocyte count observed was consistent with the findings of earlier studies using propofol and alpha 2 agonists in dogs as also reported by Surbhi et al (2010) and Singh et al. (2013) which might be due to the pooling of circulating blood cells in the spleen or other reservoirs secondary to decreased sympathetic activity in dogs.

Lymphocytopenia in the animals of all groups might be attributed to the stimulation of adrenal gland and restoration of ACTH levels. Similar observations have been reported after xylazine-propofol administration in dogs by Mukati et al. (2006). The present study indicated that there was no significant difference recorded in the values of monocytes when compared with their base line values in all the four groups. In animals of all four groups, no significant difference was recorded in the values of granulocytes in comparison to their base line values.

Glucose value increased significantly in all the four groups. Comparison among different groups revealed that blood glucose in group B₂ at 90 and 120 min intervals was significantly (P<0.05) lower than that of group B₁ and A₂ . In agreement to this, Fagerholm et al. (2004) stated that dexmedetomidine is implicated in interfering with blood glucose homeostasis via insulin inhibition, an effect suggested to be mediated via the alpha-2 adrenoceptors which causes hyperglycemia in dogs. Similar findings were also recorded by Singh et al. (2013) with butorphanol-acepromazine-glycopyrrolate-propofol-isoflurane anesthesia in orthopaedic dog patients. Kumar et al. (2013) also recorded increase in blood glucose with dexmedetomidine, propofol, ketamine anaesthesia in goats. Hyperglycemic effects of medetomidine were recorded by Surbhi et al. (2010) also; and effect of dexmedetomidine by McSweeney et al. (2012), who have been investigated in earlier studies which must be due to suppression of insulin release, stimulation of glucagon release, or both in alpha and beta cells of the
pancreas. The higher values of glucose in the present study might also be attributed to decreased membrane transport of glucose, decreased glucose utilization, impaired insulin activity and increased blood concentration of adrenocortical hormones as also reported in dogs by Restitutti et al. (2012). Hyperglycemia recorded in all four groups might be due to rise in adrenocortical hormones, release of catecholamines due to increased hepatic glucose production and decreased glucose utilization due to stress to surgery and anaesthesia.

The present study revealed a significant increase in BUN in animals of all four groups up to 120 minutes of observation period. Increase in blood urea nitrogen might be due to hypotension and reduced blood flow to kidneys leading to retention of nitrogenous substances in the blood. Increased BUN has been recorded during propofol anaesthesia in dogs premedicated with medetomidine as also reported by Surbhi et al. (2010). A consequent decrease in glomerular filtration rate might have resulted increase in BUN and creatinine levels. An increased hepatic urea production from amino acid degradation during anaesthesia could also have accounted for the observed increase in BUN and creatinine levels. Similar finding was recorded by Singh et al. (2013).

There was a significant increase in serum creatinine levels in the dogs of all four groups, which was attributed to the inhibitory effect of drugs on the renal blood flow, increased creatinine production from muscle damage and amino acid degeneration as also reported by Singh et al. (2013) and Restitutti et al. (2012). However, in the present study, the creatinine level was within the normal physiological limits, suggesting no serious deleterious effect of used anaesthetics on renal blood flow and other vital organs.

Based on the results it is concluded that the anaesthetic protocols used does not produce any side effects on haematobiochemical parameters neither in young and aged dogs. So anaesthetic protocols used in the present study are recommended for use in the clinical cases of young as well as geriatric patients.

References

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