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Evaluation of haematological and serum biochemical profile of geriatric dogs undergoing a multimodal anaesthesia protocol[#]

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Abstract

The study was conducted on six geriatric dogs belonging to different breeds presented for various surgical procedures at the Veterinary hospitals of Kerala Veterinary and Animal Sciences University, at Mannuthy and Kokkalai. Before undergoing anaesthesia, all dogs underwent complete clinical examination and pre-anaesthetic evaluation. All the animals were administered a multimodal anaesthetic protocol with inj. dexmedetomidine and inj. buprenorphine as preanaesthetics. A combination of injection diazepam and propofol was given for induction which was followed by inj. ketamine and inj. lignocaine for analgesia. Maintenance of anaesthesia was carried out by sevoflurane along with ketamine-lignocaine CRI for providing analgesia. Studies on haematology and serum biochemistry were carried out prior to premedication, during maintenance and following anaesthesia recovery. Organ functions were well preserved with the current multimodal anaesthetic technique in geriatric dogs.

Keywords: *Geriatric dogs, multimodal anesthesia, sevoflurane*

Geriatric animals are considered to be those that have lived 75-80% of their anticipated life span (Carpenter *et al*., 2005). Ageing causes progressive and irreversible changes in the functional capacities of organ systems which in turn alter the response to stress and anaesthetic drugs.

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Geriatric patients often have pathophysiological conditions and decreased organ reserve that make them more sensitive to pre-anaesthetic and anaesthetic drugs. The use of low dose tranquilizers/sedatives and opioids for pre-anaesthetic medication may be very effective in the geriatric patient (Hughes *et al*., 2008). Aggressive, careful, vigilant monitoring during the anaesthetic and recovery periods is required to detect and correct alterations in homeostasis that may develop during the perianaesthetic period. With appropriate preoperative screening, informed choice and judicious dosing of anaesthetics, and careful monitoring and supportive care, the risk of anaesthesia in geriatric animal can be greatly reduced (Lukasik *et al*., 2006).While there is no specific drug or protocol that prevents morbidity and mortality in geriatric animals, the anaestheslogists should take a multimodal approach which consists of a combination of sedatives, analgesics, muscle relaxants and general anaesthetic drugs at lower doses.

This study was aimed to evaluate the haematological and serum biochemical profile of geriatric dogs undergoing a multimodal anaesthesia protocol.

Materials and methods

The study was conducted in six geriatric dogs of either sex of different breeds with age ranging from nine to fourteen years, presented to the University Veterinary Hospitals, at Mannuthy and Kokkalai, Kerala Veterinary and Animal Sciences University Pookode, Kerala. All the animals under study were subjected to thorough pre-anaesthetic evaluation before proceeding to surgery. Food was withheld for about 12 hours and water for six hours before administration of the anaesthesia (Yamashita *et al*., 2009; Manasa *et al*., 2021).

Preanaesthesia was carried out in all the animals under study by administering buprenorphine at the dose rate of 0.02 mg per kg body weight and dexmedetomidine at the dose rate of 5 µg per kg body weight, intramuscularly at the same time. After twenty minutes, diazepam at the dose rate of 0.2 mg per kg body weight followed by propofol (1% w/v) emulsion was given as slow intravenous injection, upto effect. Immediately following this ketamine at the dose rate of 1mg per kg body weight and lignocaine at a dose rate of 2 mg per kg body weight were administered intravenously for providing analgesia. Maintenance of surgical plane of anaesthesia was carried out with 1.80 ± 0.18 % (mean value for six animals) sevoflurane in oxygen at a flow rate of 100 ml/kg body weight using Bain's circuit system. During maintenance ketamine at the dose rate of 10 µg/kg/min and lignocaine at the dose rate of 50 µg/kg /min as constant rate infusion were administered for analgesia.

Anaesthetic evaluation was carried out by continuous monitoring of anaesthetic parameters and vital signs. Blood was collected for the evaluation of haematological and serum biochemical parameters prior to anaesthesia, five minutes after sevoflurane maintenance and after recovery. Surgery was carried out in all the animals as per the standard protocols under aseptic conditions. Immediately before surgery all the animals received amoxicillin-sulbactum at the dose rate of 10 mg per kg body weight intravenously. Postoperatively, all the animals received antibiotic and anti-inflammatory drugs orally, for five consecutive days.

Results and discussion

The mean age and body weight of geriatric animals under study were 11.33 ± 0.65 years and 14.66 ± 6.3 kg respectively. The mean values of haematological and serum biochemical parameters are given in Tables 1 and 2.

It was found that the mean total leukocyte count and total erythrocyte count decreased during maintenance and increased after recovery from anaesthesia. The changes were not significant. Similar kind of reduction in the mean values of total erythrocyte count and total leukocyte count were found during sevoflurane anaesthesia in canines (Bisht *et al*., 2018), in horses (Sankar *et al*., 2011) and in geriatric dogs (Kavechiya, 2010). However in older dogs the values typically returned to baseline levels after recovery from anaesthesia (Sen and Kilic, 2018). The decrease in the leukocyte and erythrocyte counts noticed in

Table 1. Observations on haematological parameters (Mean ± SE) n =6

Parameters	Before premedication	During maintenance	After recovery from general anaesthesia
Total erythrocyte count(10^6/µL)	5.37 ± 0.34	4.82 ± 0.29	5.3 ± 0.25
Total leucocyte count(10^3/µL)	14.93 ± 1.35	13.12 ± 1.39	13.68 ± 1.41
Lymphocyte (%)	24.56 ± 1.22	26.42 ± 1.21	25.98 ± 1.17
Monocytes (%)	4.93 ± 0.29	5.75 ± 0.27	5.66 ± 0.25
Granulocytes (%)	70.51 ± 2.09	67.83 ± 1.41	68.36 ± 1.19
Haemoglobin (g/dL)	12.8 ± 0.94	9.9 ± 0.97*	12.28 ± 0.95
Volume of packed red cells (%)	34.2 ± 1.09	30.2 ± 1.20*	33.4 ± 1.5
Plateletcount (10^3/µL)	331.16 ± 49.0	264.83 ± 30.20*	256.33 ± 31.19*

Means with'*' as superscript within a row differ significantly at 5% level

Table 2. Observations on serum biochemistry (Mean ± SE) n =6

Parameters	Before premedication	During maintenance	After recovery from general anaesthesia
Alanine Aminotransferase (IU/L)	38.6 ± 4.15	37.9 ± 3.89	37. 41 ± 3.76
Aspartate aminotransferase (IU/L)	42.83 ± 1.65	41.85 ± 1.89	42.48 ±1.76
Blood Urea Nitrogen (mg/dL)	16.27 ± 0.81	17.25 ± 0.82	16.12 ± 0.81
Creatinine (mg/dL)	1.02 ± 0.18	1.08 ± 0.15	1.06 ± 0.10
Random blood sugar (mg/dL)	84.84 ± 3.65	88. 3 ± 3.27	91.35 ± 3.43
Total plasma protein (g/dL)	7.48 ± 0.24	7. 31 ±0.20	7.21 ± 0.19

Means with'*'as superscript within a row differ significantly at 5% level

the current study might be due to expansion of spleen during general anaesthesia which caused erythrocyte sequestration (Hawkey, 1985) or due to vasodilation and pooling of blood (Biermann *et al*., 2012; Singh *et al.*, 2013).

The mean values of lymphocytes and monocyte per cent increased non significantly during maintenance and decreased after recovery with no significant changes.There was a non significant decrease in mean granulocyte per cent during maintenance and increase after recovery from anaesthesia. But all the values were within the normal physiological limit.The cause might be stimulation of lymphocytes and neutrophils by glucocorticoids due to the stimulation at the adrenocortical region throughout general anaesthesia (Brand *et al.*, 2003).

The mean haemoglobin concentraion decreased significantly during maintenance and increased to baseline levels after recovery. Similar type of reduction in haemoglobin mean values were found during anaesthesia in dogs (Vijay *et al*., 2018) and in horses (Sankar *et al*., 2011). A non-significant reduction in haemoglobin value which attained baseline levels after recovery was noticed in geriatric dogs (Sen and Kilic, 2018). According to Wagner *et al*. (1991) this decrease in the value of haemoglobin could be due to the pooling of circulating erythrocytes in to the spleen. In the current study, the decreased haemoglobin level under general anaesthesia was caused by decreased total erythrocyte count (Kavechiya, 2010). The mean value of volume of packed red cells concentration decreased significantly during maintenance and increased to baseline levels after recovery. Similar kind of decreased mean value of volume of packed red cells were observed in dogs during anaesthesia (Sams *et al*., 2008; Vijay *et al*., 2018) and in horses (Sankar *et al*., 2011). This decreased value of packed red cells during anaethesia could be due to shifting of fluid to intravascular compartment from extravascular compartment (Wagner *et al*., 1991) or as a result of haemodiluton following fluid therapy (Surbhi *et al*., 2010; Singh *et al*., 2013).The mean value of platelet count decreased significantly during maintenance and after recovery. Similar kind of outcomes were obtained in dogs with propofol isoflurane anaesthesia in the work done by Sen and Kilic (2018). The mean values of alanine aminotransferase (ALT) reduced non-significantly in animals of both groups during maintenance and after recovery from anaesthesia. The outcomes were consistent with observations made in adult and geriatric dogs with propofol-isoflurane anaesthesia by Kavechiya (2010) and Sen and Kilic (2018). Reduced hepatic circulation caused by anaesthetic drugs (Shafer, 2000; Topal *et al*., 2003 and Trepenaitis *et al*., 2010) might be the cause of this decrease.

The mean values of aspartate aminotransferase (AST) reduced non-significantly in animals of both groups during maintenance and returned to normal values after recovery from anaesthesia. Similar observations were recorded by Kavechiya (2010) and Sen and Kilic (2018) in adult and geriatric dogs with propofol isoflurane anaesthesia. Hepatic hypoperfusion caused by the anaesthetic drugs might be the cause of this decline during anaesthetic period (Trepenaitis *et al*., 2010). The mean BUN values increased non significantly during maintenance and decreased non significantly to baseline levels after recovery. This is in accordance with the study conducted by Arya *et al*. (2021), Kavechiya (2010) and Dar *et al*. (2018), where a non significant increase in BUN value was noticed during anaesthesia,This was in contrast to the results obtained by Sen and Kilic (2018) where a non significant decrease in BUN value was noticed with propofol-isoflurane anaesthesia in geriatric dogs. This increase in BUN values could be due to hypotension and restricted blood flow to kidneys (Surbhi *et al*., 2010) which cause retention of nitrogenous compounds in blood. There was a non-significant increase in the creatinine value during maintenance and returned to baseline levels after recovery . This is in line with the results obtained by Kavechiya (2010) in adult dogs, where a non-significant increase in the creatinine value was noticed with propofol-isoflurane anaesthesia. Both sevoflurane and isoflurane did not significantly modify the BUN and creatinine values in patients with renal insufficiency when compared to baseline values (Conzen *et al*., 2002). The mean value of random blood sugar increased during maintenance and after recovery. Similar kind of non-significant increase in the blood glucose level was reported by Kavechiya (2010), Ramankutty (2008) and Vijay *et al*. (2018) in dogs. This increase in glucose level during anaesthesia might be due to increased sympathetic stimulation or due to decreased glucose transport through membranes, decreased glucose utilisation, suppression of insulin activity and increased concentration of adreno cortical hormones in blood (Restitutti *et al*., 2012).

The mean value of total plasma protein decreased non-significantly during maintenance and after recovery. This was in accordance with the result obtained from the studies conducted by Kavechiya (2010) and Tomihari *et al*. (2015) that there was non-significant decrease in the value of total plasma protein in adult dogs with propofol and isoflurane anaesthesia.

Conclusion

There were no complications in the geriatric dogs undergoing this multimodal anaesthesia protocol.Variations in haematological and serum biochemical parameters were within the normal acceptable range. The present multimodal anaesthetic protocol was found to be safe in geriatric dogs with regard to haematological and serum biochemical parameters.

Conflict of interest

The authors declare that they have no conflict of interest.

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