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RESEARCH ARTICLE

HAEMATO-BIOCHEMICAL EFFECTS OF DEXMEDETOMIDINE IN DOG

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ABSTRACT

Ten clinically affected mongrel dogs of either sex and different age groups, weighing 10-20 kg were randomly divided into two groups comprising of five dogs in each group. The dogs of group I were injected with dexmedetomidine @ 20 µg/kg body weight intramuscularly, dogs of group II were injected with dexmedetomidine @ 40 µg/kg body weight intramuscularly. Haemoglobin reduced non-significantly ($p>0.05$) and TEC reduced significantly ($p<0.05$) in the dogs of both the groups. Significant ($p<0.01$) reduction in the values of PCV and TLC was observed in both the groups. Gamma Glutamyl Transferase (GGT), Blood glucose, Blood Urea Nitrogen (BUN) and Creatinine level increased significantly ($p<0.01$) in the dogs of both the groups receiving Dexmedetomidine injection. Alkaline phosphatase decreased significantly ($p<0.01$) whereas, Total Protein level decreased non-significantly ($p>0.05$) in the dogs of both the groups. Significant ($p<0.05$) increase in the level of Serum Cortisol was observed in both the groups. All the changes were transient and optimum duration was recorded in group I. Based on the findings of the present study, dexmedetomidine @ 20 µg/kg body weight intramuscularly could be suggested for clinical use in dogs.

INTRODUCTION

α-2-adrenoceptor agonists produce the central effects of sedation and light analgesia and has been widely used in clinical veterinary medicine for calming and quietening animals. Low dose of α-2-adrenoceptor agonist drugs have an anxiolytic property similar to benzodiazepines (Macdonald *et al.*, 1989) while high doses produce sedation (Clarke and England, 1989) and analgesia (Ylisela and Vainio, 1989). α-2-adrenoceptor agonists decrease respiratory rate and bradycardia (Clarke and England, 1989). Dexmedetomidine, a new member of the α-2 agonists group with higher potency and selectivity than xylazine and detomidine (Virtanen *et al.*, 1988; Aantaa *et al.*, 1993) is mainly used in human. However, in recent years scanty information has seen about its use in dogs, but standardization of this drug is yet to be completed. Looking to the availability of this drug in India, its dose dependant activity of sedation, analgesia and muscle relaxation, it was contemplated for establishing a suitable dose of Dexmedetomidine in dog.

MATERIALS AND METHODS

Ten clinical cases of mongrel dogs, presented to the Department of Surgery and Radiology, College of Veterinary Science, AAU Khanapara, requiring surgical intervention for various ailments, were considered for this study. The dogs of different age group of either sex, weighing 10-20 kg were randomly divided into two groups consisting of five dogs in each group. They were kept off fed for 12 hours prior to anaesthesia.

Clinical and physiological parameters were studied in all the dogs of each group which received anaesthesia as follows:

Group I : Dexmedetomidine[1] @ 20 µg/ kg body weight intramuscularly
Group II : Dexmedetomidine @ 40 µg/ kg body weight intramuscularly

Following administration of anaesthetic agent blood samples were collected from cephalic vein at different time intervals for estimation of haematological and biochemical parameters. Haematological parameters include Haemoglobin (Hb), Packed Cell Volume (PCV), Total Leucocyte Count (TLC) and Total Erythrocyte Count (TEC). One millilitre of venous blood from ceplalic vein was collected at 0th, 5th, 15th, 30th, 45th, 60th & 90th minute of anaesthetic injection in commercially available sterile 2 ml vacuum blood collection tube (eVac tube) containing K_3EDTA[2] and utilised for estimation of the same using standard methods as described by Schalm *et al.* (1975).

[1] Alphadex 0.01% injection, Themis Medicare Ltd., India
[2] Peerless Biotech Pvt. Ltd., Millennium House, Perungudi, Chennai- 600096, India

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Biochemical parameters include Gamma Glutamyl Transferase(GGT), Alkaline Phosphatase, Glucose, Blood Urea Nitrogen, Creatinine, Cortisol and Total Protein. Two millilitres of venous blood from ceplalic vein was collected at 0^{th} , 5^{th} , 15^{th} , 30^{th} , 45^{th}, 60^{th} & 90^{th} minute of anaesthetic administration in commercially available sterile 5 ml vacuum blood collection tube (eVac tube) containing clot activator[3] (Serum/ Pro-coagulation Tube). Immediately after collection, the blood samples were kept undisturbed in a slanting position for clot formation and serum separation. Serum was separated with the help of fine rubber pipette and stored in labelled micro centrifuge tube. The serum samples were utilised for estimation of the same parameters using commercially available kits in a spectrophotometer[4].

The data were processed by SAS 9.3 package (2012) available in Biostatistics Laboratory, Department of Livestock Production and Management, college of Veterinary Science, Khanapara facilitated by ICAR under NAIP(component-I).

RESULTS AND DISCUSSION

Haemoglobin levels decreased non-significantly ($p>0.05$) from 13.24 ± 0.51 to 11.96 ± 0.43 g/dl and 13.11 ± 0.69 to 11.53 ± 0.49 g/dl in group I and group II respectively following administration of dexmedetomidine. This decrease in Hb might be attributed to decreased sympathetic activity after dexmedetomidine administration leading to spleenic pooling of circulatory erythrocytes (Skarda and Muir, 1996). Significant reduction ($p<0.01$) in the Packed cell volume from 40.66 ± 1.23 to 36.44 ± 1.15 % in group I and from 35.30 ± 1.08 to 33.98 ± 1.18 % in group II was observed following injection of dexmedetomidine in the dogs. This significant reduction might be attributed to decrease sympathetic activity after dexmedetomidine injection leading to spleenic pooling of circulating erythrocytes or other reservoirs. Haemodilution might be the cause of decreased PCV in peripheral blood (Skarda and Muir, 1996). TEC decreased significantly ($p<0.05$) in the dogs from 6.38 ± 0.29 to 5.46 ± 0.29 × 10^6/cu mm in group I and from 6.30 ± 0.21 to 5.26 ± 0.67 × 10^6/cu mm in group II receiving dexmedetomidine. Spleenic pooling of erythrocyte and subsequent haemodilution might be the cause of reduced erythrocytes level in peripheral blood. Significant reduction ($p<0.01$) in the TLC level from 14.20 ± 0.49 to 12.93 ± 0.44 × 10^3/cu mm in group I and from 14.03 ± 0.68 to 12.65 ± 0.63 × 10^3/cu mm in group II receiving dexmedetomidine. Maximum reduction in TLC level was observed at 45 minutes in group I and at 60 minutes in group II following anaesthetic administration. The decrease in TLC might be due to enhanced peripheral blood level of adrenaline or nor-adrenaline which suppresses proliferative response of peripheral blood leucocytes (Felsner *et al.*, 1995) or spleenic pooling of blood cells.

Significant ($p<0.01$) rise in serum Gamma Glutamyl Transferase (GGT) levels were recorded in the dogs from 2.24 ± 0.26 to 3.94 ± 0.32 U/L in group I and 2.95 ± 0.33 to 3.75 ± 0.26 U/L in group II. Peak levels were recorded at 90 minutes in group I and 60 minutes in group II after anaesthetic administration which returned towards the base level thereafter. These findings were suggestive of transient cholestasis which reduces following elimination of the drug by the end of the observation period. Braun *et al.* (1983) was in agreement with the present study that transient cholestasis caused increase in serum GGT level. Alkaline phosphatase level reduced significantly ($p<0.01$) in the serum in the dogs from 4.09 ± 0.12 to 3.49 ± 0.18 K.A. unit and 3.86 ± 0.09 to 2.70 ± 0.06 K.A. unit in group I and group II respectively following dexmedetomidine anaesthesia. This reduction might be due to the pre anaesthetic fasting of dogs which reduced the intestinal isoenzyme of alkaline phosphatase resulting in significant decrease (Kaneko, 2008). The finding of the present study is in agreement with the findings of Flock and Bollman (1948) who reported decrease in alkaline phosphatase levels in fasting dogs, rats and guinea pigs. Serum glucose increased significantly ($p<0.01$) in the dogs of all the groups receiving dexmedetomidine anaesthesia. The serum glucose level increased from 72.20 ± 5.05 to 133.00 ± 10.36 g/dl in group I and 70.00 ± 7.97 to 123.00 ± 8.75 g/dl in group II. Increase of blood glucose level might be attributed to the effect of α-2-adrenoceptor agonists that was associated with growth hormone stimulation and insulin suppression through direct inhibitory effect of dexmedetomidine on the pancreatic β-cells (Dollery, 1991). Low insulin activity hampers serum glucose utilization resulting in subsequent rise of serum glucose levels (El-Maghraby, 2005). Blood urea nitrogen increased significantly ($p<0.01$) in the dogs from 22.84 ± 1.76 to 38.94 ± 0.72 mg/dl in group I and 20.56 ± 1.11 to 36.64 ± 0.85 mg/dl in group II receiving dexmedetomidine anaesthesia. Increase in BUN level might be due to the fact that inhibitory affect of anaesthesia decreased glomerular filtration and passive reabsorption was increased when urine flow in the tubule reduced. This finding was in agreement with Park and Rabinowitz (1969) in dogs. Significant ($p<0.01$) rise in the serum creatinine level was recorded in the dogs of all the groups receiving dexmedetomidine anaesthesia. The creatinine level increased from 0.68 ± 0.05 to 1.54 ± 0.02 mg/dl in group I and 0.77 ± 0.06 to 1.59 ± 0.05 mg/dl in group II and started declining after 45 minutes in all the groups. This increase in creatinine level might be attributed due to the increased levels of anti diuretic hormones (ADH) and decreased renal perfusion leading to the decreased glomerular filtration during anaesthesia. Significant ($p<0.05$) increase in the level of serum cortisol from 79.04 ± 27.21 to 265.26 ± 20.90 nmol/L in group I and from 135.98 ± 35.88 to 240.22 ± 41.21 nmol/L in group II was recorded in the dogs of all the groups following dexmedetomidine anaesthesia. This increase in serum cortisol might be attributed due to increased level of stress of anaesthesia. Moreover in all the groups the serum cortisol level constantly increased up to 45 minutes which might be due to the increased depth of anaesthesia. This is in agreement with the findings of Church *et al.* (1994), who reported that all forms of anaesthesia and surgery produced a significant increase in plasma cortisol concentration which returned to normal after 24 hours. The serum total protein level decreased non-significantly ($p>0.05$) in the dogs from 61.04 ± 2.74 to 56.18 ± 2.80 g/dl in group I and from 62.42 ± 3.10 to 58.77 ± 3.03 in group II following dexmedetomidine administration. This non-significant decrease of total protein in dogs might be

[3] Hebei Xinle Sci. & Tech Co. Ltd., No- 189, Nanhuan Road, Hebei Province, China
[4] Spectrophotometer -106, Systronics, Ahmedabad, Sl. No 5515, India

due to inter compartmental fluid shift causing haemodilution. Similar observations were reported by Amarpal and Kumar (1995) in bovines. Increased level of cortisol might also be another cause to decrease total serum protein because of their catabolic affects as stated by Kaneko (2008).

CONCLUSION

After conducting the present study Dexmedetomidine @ 20 µg/kg body weight intramuscularly was found superior than that of the same @ 40 µg/kg body weight intramuscularly in respect of haematological and biochemical parameters. Hence, Dexmedetomidine @ 20 µg/kg body weight intramuscularly alone could be suggested for clinical use in dogs.

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