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Haemato-biochemical comparision of xylazine/dexmedetomidine in combination with butorphanol/pentazocine as preanesthetic to ketamine anaesthesia in canine pyometra patients

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Abstract
The study was conducted on 24 female dogs suffering from pyometra, divided randomly into 4 groups of six animals in each group. Atropine was administered @ 0.04 mg/kg body weight IM followed after 5 minutes by xylazine @ 0.5 mg/kg body weight in groups A and B while dexmedetomidine was administered @ 10 µg/kg body weight in groups C and D via IM route. Additionally, in group A and C, butorphanol was administered @ 0.2 mg/kg body weight while in group D pentazocine @ 2 mg/kg body weight was administered through IM route. After 10 minutes of premedication, anaesthesia was induced with ketamine administered as single bolus in all the groups. The maintenance of anaesthesia was carried out with ketamine as IV when needed. Adequate muscle relaxation, sedation and analgesia necessary for surgical intervention were achieved in all patients. Recovery was smooth and uneventful in all the groups. The animals of groups C and D regained recovery and attained sternal and standing position after a longer duration as compared to groups A and B. Haemoglobin, PCV and TLC decreased in all the groups but there were no significant difference among the groups. Neutrophilia concurrent with lymphocytopenia was recorded in the animals of all groups. An increase in plasma urea nitrogen, plasma glucose and plasma creatinine were recorded in the animals of all the groups. The values of SpO2 revealed significant decrease after premedication and during post-induction period in all the groups. It was concluded that dexmedetomidine-butorphanol and/or pentazocine combination produced a comparable degree of clinico-physiological and haemodynamic stability during ketamine anaesthesia in dogs undergoing ovariohysterectomy following pyometra and may be recommended for balanced anaesthesia in critically ill canine patients.

Keywords: butorphanol, dog, ketamine, ovariohysterectomy, pentazocine, pyometra

Introduction
Pyometra by definition accumulation of purulent material within the uterine lumen. Canine pyometra is a disease syndrome that affect intact bitches, causing a variety of clinical and pathological signs of genital and systemic disease. It is of particular importance to veterinary practitioner, since early recognition, diagnosis and appropriate intervention is required to avoid fatal consequences. The clinical signs of pyometra are not limited to genital tract. The most frequently reported clinical signs include anorexia, vomiting, polydipsia and polyurea, lethargy and vulvar discharge (Pretzer, 2008) [14]. In most cases, the choice of treatment is ovario-hysterectomy. Elective ovariohysterectomy is the most frequently performed surgical procedure in companion animal practice (Fox *et al*. 2000) [5] and the Centre for Veterinary Medicine of the US Food and Drug Administration considers ovariohysterectomy to cause moderate pain, making it suitable for clinical studies of analgesia. Anaesthesia is an indispensable pre-requisite to most of the surgical interventions, so that the surgeon can perform surgical intervention with maximum precision and sagacity. An ideal anaesthetic produces sedation, amnesia, analgesia and muscle relaxation. However, all these characteristics cannot be provided by a sole agent and therefore, a combination of drugs is used which is referred to as "balanced anaesthesia" (Thurmon and Short, 2007) [22]. Alpha-2 agonists are the most commonly used sedatives in veterinary practice as they induce reliable and dose dependent sedation, analgesia and muscle relaxation that can be readily reversed by administration of selective antagonists (Lemke, 2004) [7]. Xylazine is the first alpha-2 agonist which has been used in veterinary practice for sedation and analgesia.

In dogs and cats, xylazine has been used alone or in combination with opioids to provide sedation and analgesia for diagnostic and minor surgical procedures. However, vomiting, bradycardia and arterial hypotension are some of the known side effects of xylazine in dogs. Combinations of butorphanol and alpha-2 adrenoceptor agonists provide reliable and uniform sedation in dogs and cats, although significant decreases in heart and respiratory rates are observed. Pentazocine has partial agonistic activity on mu and delta-opiate receptors and full agonistic activity on kappa and sigma-opiate receptors (Tripathi, 1999) [23]. Ketamine provides cardiovascular stability when given with xylazine-butorphanol preanaesthetized dogs. Ketamine increases muscle tone and induces spontaneous movement and, occasionally, convulsions but these undesirable effects are avoided by using ketamine in conjunction with propofol, benzodiazepines, acepromazine or alpha-2 agonists. Constant rate infusion of ketamine has been shown to reduce the total dose of the ketamine requirement, increase cardiovascular stability and reduce side effects like muscular rigidity, emergence reaction and respiratory depression (White, 1983) [25]. The present study was undertaken to compare the haemato-biochemical changes and anaesthetic effects of ketamine anaesthesia in canine pyometra patients premedicated with dexmedetomidine/ xylazine and butorphanol/ pentazocine combination.

Materials and Methods

The study was conducted on 24 female dogs suffering from pyometra. These were divided into four groups randomly having six animals in each group. The groups of animals were designated as group A, B, C and D on the basis of preanaesthetics/anaesthetic used. The animals of different groups were administered with following drugs for sedation, analgesia and anaesthesia. In group A, anaesthesia was achieved by a combination of atropine (Atropine sulphate: Amba Research Laboratories, Patna), xylazine (Xylaxin: Indian Immunologicals Limited, Hyderabad), butorphanol (Butodol: Neon laboratories Limited, Mumbai) and ketamine (Aneket: Neon laboratories Limited, Mumbai). Atropine was given @ 0.04 mg/kg IM followed after 5 minutes by xylazine @ 0.5 mg/kg and butorphanol @ 0.2 mg/kg administered simultaneously through IM route using separate syringes.In group B, administration of atropine @ 0.04 mg/kg IM followed after 5 min by xylazine @ 0.5 mg/kg andpentazocine (Fortwin: Ranbaxy laboratories, Mumbai) @ 2 mg/kg simultaneously through IM route using separate syringes was done. In group C, atropine was given @ 0.04 mg/kg IM followed after 5 min by dexmedetomidine (Dextomid: Neon laboratories Limited, Mumbai) at the dose rate of 10 µg/kg and butorphanol @ 0.2 mg/kg administered IM simultaneously using separate syringes. In group D, atropine @ 0.04 mg/kg followed 5 min later by dexmedetomidine at the dose rate of 10 µg/kg and pentazocine @ 2 mg/kg were administered simultaneously IM using separate syringes. Induction of anaesthesia was made after 10 minutes of the preanaesthetic medication by administration of ketamine IV bolus till effect. Maintenance was done by incremental doses of ketamine as and when needed during surgery.The animals were left undisturbed for 10 min and recording of oxygen-haemoglobin saturation (SpO2) with the help of pulse-oxymeter were recorded. Haematological and biochemical parameters viz., haemoglobin (Hb), packed cell volume (PCV), total leucocyte count (TLC), differential leucocyte count (DLC), plasma urea nitrogen diacetyl monoxide (DAM) method, plasma glucoseby GOD/POD method andplasma creatinine by alkaline picrate method were estimated at different time intervals. Analysis of variance (ANOVA) and Duncan"s multiple range tests (DMRT) were 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 (Snedecor and Cochran, 1980) [21]. For non-parametric observations Kruskal-Wallis one-way test was used to compare the mean between the groups at corresponding intervals (Siegel and Castellan, 1988) [17].

Results

Haemoglobin

The mean ± SE values of haemoglobin (g/L) in different groups at various time intervals are shown in Table -1. A significant (P<0.05) decrease in Hb values was recorded in the animals of group A at 10 and 60 min interval while the values showed highly significant (P<0.01) decrease at 30 and 45 min interval. However, the values were non-significantly (P>0.05) decreased than the base value at 90 min interval. In group B, a significant (P<0.05) decrease in Hb values was recorded at 15 and 60 min interval while the values revealed highly significant (P<0.01) decrease at 45 min interval. However, the values were non-significantly (P>0.05) decreased at 30 and 90 min interval as compared to the base value. In animals of group C, haemoglobin values revealed non-significantly (P>0.05) decreased Hb values at most of time intervals except for significantly (P<0.05) decreased values at 45 min interval while the values were non-significantly (P>0.05) increased as compared to base value at 90 min interval. In group D, a highly significant (P<0.01) decrease in Hb values was recorded at most of time intervals throughout the observation period except for non-significantly (P>0.05) decreased values at 90 min interval. Comparison among different groups did not revealed any significant difference in Hb values in the animals of different groups.

Packed cell volume

The mean ± SE values of packed cell volume (L/L) in different groups at various time intervals are shown in Table 2. In group A, a significant (P<0.05) decrease in PCV values was recorded throughout the observation period. A significant (P<0.05) decrease in PCV values was recorded throughout the observation period in the animals of group B except for highly significant (P<0.01) decrease in PCV values at 45 min interval. In group C, PCV values remained non-significantly (P>0.05) lower than the base value from 15 min onwards till 60 min interval followed by non-significantly (P>0.05) decreased PCV values at 90 min interval. A significant (P<0.05) decrease in PCV value was recorded in the animals of group D at most of time intervals throughout the observation period except for highly significant (P<0.01) decreased PCV values at 45 min interval. Comparison among different groups did not revealed any significant difference in PCV values in the animals of different groups.

Total leucocyte count

The mean ± SE values of total leucocyte count (x109/L) in different groups at various time intervals are shown in Table 3. A highly significant (P<0.01) decrease in TLC value was recorded in the animals of group A at 15 min interval

followed by significantly ($P<0.05$) decreased TLC values from 30 min onwards till 60 min interval. However, the values were non-significantly ($P>0.05$) decreased than the base values at 90 min interval. In group B, significantly ($P<0.05$) decreased TLC values were recorded from 15 min onwards till end of the observation period. A highly significant ($P<0.01$) decrease in TLC value was recorded in the animals of group C at 15 and 30 min interval followed by significantly ($P<0.05$) decreased TLC values from 45 min onwards till completion of the observation period. In group D, a highly significant ($P<0.01$) decrease in TLC values was recorded at 15 and 45 min interval while the values were significantly ($P<0.05$) decreased than the base values at 30 min interval. However, the values were non-significantly ($P>0.05$) decreased as compared to the base values at 60 and 90 min interval. The difference in TLC values between groups at different intervals was not significant.

Neutrophils

The mean ± SE values of neutrophils (%) in different groups at various time intervals are shown in table 4. A non-significant ($P>0.05$) increase in neutrophil count was recorded in the animals of group A throughout the observation period except for highly significant ($P<0.05$) increase in neutrophil count values at 30 min interval. In animals of group B, a non-significant ($P>0.05$) increase in neutrophil count was recorded throughout the observation period. A non-significant ($P>0.05$) increase in neutrophil count was recorded in the animals of group C at 15 min interval followed by significantly ($P<0.05$) increased neutrophil count from 30 min onwards till 90 min. In animals of group D, neutrophil count recorded a non-significant ($P>0.05$) increase throughout the observation period except for significantly ($P<0.05$) increased neutrophil count values at 30 min. Comparison among different groups did not reveal any significant difference in neutrophil count values in the animals of different groups.

Lymphocytes

The mean ± SE values of lymphocytes (%) in different groups at various time intervals are shown in table 5. A non-significant ($P<0.05$) decrease in lymphocyte count was recorded in the animals of group A at 15, 60 and 90 min interval. However, the values were significantly ($P<0.05$) decreased than the base value at 30 min interval while the values were highly significantly ($P<0.01$) decreased as compared to the base values at 45 min interval. In animals of group B, a significantly ($P<0.05$) decrease in lymphocyte count was recorded from 15 min onwards till 75 min interval. However, the values were non-significantly ($P>0.05$) decreased than the base values at 90 min. A non-significant ($P>0.05$) decrease in lymphocyte count was recorded in the animals of group C at 15 and 90 min interval while the values were significantly ($P<0.05$) decreased than the base values from 30 min onwards till 60 min interval. In animals of group D, a non-significant ($P>0.05$) decrease in lymphocyte count was recorded at most of the time intervals throughout the observation period except for non-significantly ($P>0.05$) increased lymphocyte count values at 90 min interval. The difference in lymphocyte count between groups at different intervals was not significant.

Plasma glucose

The mean ± SE values of plasma glucose (mmol/L) in different groups at various time intervals are shown in Table 6. A significant ($P<0.05$) increase in plasma glucose value was recorded in animals of group A at 15 min followed by highly significant ($P<0.01$) increase in glucose values from 30 min onwards till completion of the experiment. In animals of group B, a non-significant ($P>0.05$) increase in plasma glucose value was recorded throughout the observation period except for 30 min interval where the values were significantly ($P<0.05$) higher than the base value. A non-significant ($P>0.05$) increase in plasma glucose value was recorded in the animals of group C throughout the observation period. In animals of group D, a non-significant ($P>0.05$) increase in plasma glucose value was recorded throughout the observation period except for significantly ($P<0.05$) increased plasma glucose values at 60 min interval. Comparison between groups did not reveal any significant difference in plasma glucose values at different interval of time.

Plasma urea nitrogen

The mean ± SE values of plasma urea nitrogen (mmol/L) in different groups at various time intervals are shown in Table 7. A non-significant ($P>0.05$) increase in plasma urea nitrogen value was recorded in the animals of group A at 15 and 90 min interval while the values showed highly significant ($P<0.01$) increase as compared to the base values from 30 min onwards till 60 min. In group B, values of plasma urea nitrogen increased non-significantly ($P>0.05$) than the base value throughout the observation period except for significant ($P<0.05$) increase in PUN values at 45 min interval. A non-significant ($P>0.05$) increase in plasma urea nitrogen value was recorded in the animals of group C throughout the observation period except for significantly ($P<0.05$) increased values at 30 min interval. In group D, values of plasma urea nitrogen increased non-significantly ($P>0.05$) than the base value throughout the observation period. Comparison among the groups did not reveal any significant difference in plasma urea nitrogen values at different intervals of time.

Plasma Creatinine

The mean ± SE values of plasma creatinine (µmol/L) in different subgroups at various time intervals are shown in Table 8. A highly significant ($P<0.01$) increase in plasma creatinine value was recorded in the animals of group A throughout the observation period. In animals of group B, a highly significant ($P<0.01$) increase in plasma creatinine value was recorded throughout the observation period. A significant ($P<0.05$) increase in creatinine values was recorded in the animals of group C from 15 min onwards till 60 min followed by non-significantly ($P>0.05$) increased values at 90 min. In animals of group D, a non-significant ($P>0.05$) increase in creatinine values was recorded at most of the time intervals throughout the observation period except for highly significant ($P<0.01$) increase in creatinine values at 30 min interval. Comparison between groups revealed a significantly ($P<0.05$) higher creatinine value in the animals of group B at 45 min as compared to group D. Comparison among the groups did not reveal any significant difference in plasma creatinine values at different interval of time.

Haemoglobin oxygen saturation

The mean ± SE values of SpO2 (%) in the animals of different groups are shown in Table 9. A highly significant ($P<0.01$) decrease in SpO2 values was recorded in the animals of group

A at 10, 30 and 45 min while significantly ($P<0.05$) decreased SpO2 values were recorded at 15 min and from 45 min onwards till 90 min interval. In group B, a highly significant ($P<0.01$) decrease in SpO2 values as compared to the base value was recorded throughout the observation period. In animals of group C, haemoglobin oxygen saturation values followed a similar trend as observed in the animals of group B. In group D, a highly significant ($P<0.01$) decrease in SpO2 values was recorded from 10 min onwards up to 75 min followed by non-significantly ($P>0.05$) reduced SpO2 values at 90 min interval. Comparison between groups revealed that SpO2 values did not differ significantly among other groups.

Discussion

Haemoglobin values decreased significantly ($P<0.05$) in the animals of all the groups throughout the observation period. Similarly, a significant ($P<0.05$) decrease in PCV and TLC was recorded at most of the intervals in all the subgroups. Differential leucocyte count revealed neutrophilia along with lymphocytopenia at most of the time intervals during the observation period. Pooling of circulatory blood cells in the spleen or other reservoirs secondary to decreased sympathetic activity may explain the decrease in Hb, PCV and TLC recorded in the present study (Wagner *et al*., 1991) [24]. In the present study also inter-compartmental fluid shift or spleenic pooling of cells might have occurred and caused a decrease in Hb and PCV. The decreased Hb and PCV in the present study have also been reported. The findings of present study are in accordance with those reported following use of xylazine with butorphanol in dogs anaesthetized with ketamine (Sika, 2013) [18].

An increase in neutrophil count along with concurrent fall in lymphocyte count has been reported following use of dexmedetomidine along with midazolam-fentanyl combination in dogs and midazolam-butorphanol combination in sheep. An increase in neutrophil count along with concurrent lymphocytopenia has also been reported following use of xylazine-butorphanol combination in dogs anaesthetized with ketamine (Sika, 2013) [18]. Reduced Hb and PCV values have also been reported following administration of dexmedetomidine-pentazocine-midazolam in dogs (Rafee, 2013) [15].

A significant ($P<0.01$) decrease in SpO2 was observed in all the groups in the present study. Decrease in SpO2 values was possibly due to a certain degree of respiratory depression in all the groups. A decrease in RR was recorded in all the groups and this might also be responsible for reduced SpO2 in the present study. Low SpO2 is indicative of reduced arterial oxygenation and diminished tissue perfusion. Vasoconstriction can lead to reduced SpO2 (Leppanen *et al.* 2006) [8]. Initial decrease in SpO2 in animals of all the groups may be attributable to vasoconstriction caused by xylazine. Similarly, depression of respiration is caused by pentazocine, butorphanol and ketamine (Muir *et al*. 1999) [12].

Plasma urea nitrogen values increased significantly ($P<0.05$) at most of the time intervals during surgical stage of anaesthesia in most of the animals throughout the observation period. The increase in urea nitrogen values might be attributed to the temporary inhibitory effects of anaesthetic drugs on the renal blood flow, which in turn might have caused a rise in plasma urea nitrogen level as suggested by Kinjavdekar *et al*. (2000) [6]. The increased hepatic urea production from amino acid degradation could also account for the observed increase in blood urea values during the maximum depth of anaesthesia. However, it is difficult to describe this to possible renal damage, because all the reported values were within the normal physiological limits.

Increased BUN values have been recorded in dogs premedicated with xylazine-butorphanol (Sika, 2013) [18]. Similar findings about plasma urea nitrogen were reported after administration of xylazine alone in cows and in combination with fentanyl followed by isoflurane maintenance in buffaloes (Singh, 2011) [19]. However, no change in serum urea nitrogen was observed after xylazine administration in goats. A non-significant increase in blood urea nitrogen has been reported following use of medetomidine along with butorphanol in dogs (Ahmad, 2010; Santhosh, 2011) [1, 16], sheep (Monsang, 2011) [11] and buffaloes (Malik *et al*. 2011) [9]. However, urea values have been reported to decrease following administration of butorphanol with xylazine, medetomidine and dexmedetomidine administration (Surbhi *et al*. 2010) [20] in canine patients undergoing orthopaedic surgery. However, slight variation in plasma urea nitrogen has been reported after medetomidine administration in goats. Plasma urea nitrogen values increased non-significantly in dogs premedicated with xylazine-butorphanol followed by ketamine anaesthesia in dogs undergoing hysterectomy (Sika, 2013) [18]. A non-significant increase in BUN values have also been reported following administration of dexmedetomidine-butorphanol/pentazocine as preanaesthetic followed by induction with midazolam and maintenance with ketamine in dogs (Rafee, 2013) [15]. A non-significant increase in blood urea nitrogen has been reported following use of midazolam-dexmedetomidine in dogs (Ahmad, 2010; Santhosh, 2011) [1, 16]. Similar findings have been reported following administration of medetomidine with butorphanol and midazolam in propofol anaesthetized sheep (Monsang, 2011) [11].

Plasma glucose values revealed an increasing trend in all the groups at most of the time intervals throughout the observation period. The increase in plasma glucose observed in the present study might be attributed to an alpha-2 adrenergic inhibition of insulin released from beta cells of pancreas and increased glucose production in the liver. Hyperglycemia may also be attributed to the traumatic stress or increased muscular activity and sympathetic stimulation caused by restraining the animals resulting into increased secretion of adrenocortical hormones (Mirakhuretal., 1984) [10].

Hyperglycaemic effects of alpha-2 agonists are well known. Increase in plasma glucose after medetomidine-ketamine administration has been reported in goats (Kinjavdekar *et al*., 2000) [6]. Similarly, administration of xylazine in cattle and buffaloes, sheep and goats has also been reported to cause hyperglycaemia. Increased glucose have also been reported following administration of medetomidine/dexmedetomidine-butorphanol followed by propofol induction and maintenance in canine orthopaedic patients (Surbhi *et al*. 2010) [20], buffaloes (Malik *et al*. 2011; Singh, 2012) [9, 19] and sheep (Monsang, 2011) [11]. Practically every anaesthetic stimulates the secretion of cortisone from adrenal cortex, responsible for gluconeogenesis leading to increased glucose production during anaesthesia. Mild increase in glucose level has been reported in ketamine treated sheep (Nowrouzian *et al*. 1981) [13]. Ketamine has been reported to cause sympathetic stimulation leading to release of catecholamines and increased

glucose concentration in plasma. However, alpha-2 agonist administration as preanaesthetic agent might also have contributed to increased glucose level.

Plasma creatinine values increased significantly ($P<0.01$) at most of time intervals in the animals of all groups. However, the values were within the normal physiological range in all groups. Creatinine values were reported to increase non-significantly following administration of butorphanol along with xylazine and medetomidine (Surbhi *et al*. 2010) [20] in propofol anaesthetized canine orthopaedic patients and healthy buffaloes (Ahmad, 2009; Malik *et al*. 2011b) [1, 9]. The increase in plasma creatinine values might be attributed to the temporary inhibitory effects of anaesthetic drugs on the renal blood flow as reported in goats (Kinjavdekar *et al*., 2000) [6] and sheep (Monsang, 2011) [11]. In contrast to our findings, a slight variation in plasma creatinine values has been reported after xylazine administration in goats (Kumar and Thurmon, 1979). In contrast to this, non-significant decrease in creatinine value under xylazine-thiopental anaesthesia in buffalo calves has been reported. A non-significant variation in creatinine values in our study has also been reported in acepromazine-xylazine-ketamine anaesthetized buffalo calves (Singh *et al.* 2011) [19]. A non-significant increase in creatinine values have been reported following medetomidine-ketamine anaesthesia in dogs (Chonde *et al*. 2004) [4].

A non-significant variation in blood creatinine value has been recorded following administration of dexmedetomidine along with butorphanol (Ahmad, 2010; Santhosh, 2011) [1, 16] in dogs. However, a non-significant decrease in creatinine values following dexmedetomidine-butorphanol-propofol anaesthesia has been reported in canine orthopaedic patients. A non-significant change in creatinine was recorded after administration of pentazocine alone and in combination with acepromazine, detomidine and diazepam in buffalo calves, pentazocine-propofol anaesthesia (Chandrashekarappa *et al*. 2009) [3] and epidural administration of lignocaine-pentazocine and centbucridine-pentazocine (Bhannaria *et al*. 2005) [2] in dogs.

A non-significant variation in creatinine values have been reported following premedication with dexmedetomidine-butorphanol followed by ketamine or propofol anaesthesia in uraemic goats. In contrast to findings of present study, decreased creatinine levels below the baseline in the animals have been reported following administration of dexmedetomidine-butorphanol/pentazocine as preanaesthetic followed by induction with midazolam and maintenance with ketamine in dogs (Rafee, 2013) [15]. The rise in creatinine values in the present study was within normal physiological range might be due to continuous intravenous fluid infusion which could have maintained adequate renal blood flow and enough glomerular filtration rates to maintain plasma creatinine values within acceptable limits.

Table 1: Mean ± SE values of haemoglobin (g/L) in different groups at different intervals

S. No	haemoglobin (g/L)					
	0 min	15 min	30 min	45 min	60 min	90 min
1	88.83± 2.61	82.33± 3.11*	80.17± 2.40**	76.17± 2.24**	82.17± 2.93*	83.67± 3.08
2	87.00± 2.73	82.67± 3.14*	80.50± 3.91	80.00± 2.48**	82.50± 2.78*	83.17± 2.70
3	82.67± 3.37	79.67± 2.99	78.83± 3.19	76.83± 2.10*	79.67± 2.81	83.33± 3.44
4	85.17± 2.86	80.83± 2.48**	77.33± 2.75**	75.50± 2.47**	77.67± 1.76**	83.67± 4.04

*Significantly different from base value ($P<0.05$)
**Significantly different from base value ($P<0.01$)
Values with different superscripts differ significantly ($P<0.05$) among the groups

Table 2: Mean ± SE values of packed cell volume (L/L) in different groups at different intervals

S. No	packed cell volume (L/L)					
	0 min	15 min	30 min	45 min	60 min	90 min
1	0.30±0.01	0.28± 0.01*	0.27± 0.01*	0.26± 0.01*	0.27± 0.01*	0.28± 0.01*
2	0.29± 0.01	0.28± 0.01*	0.27± 0.01*	0.26± 0.01**	0.27± 0.01*	0.28± 0.01*
3	0.28± 0.01	0.26± 0.01*	0.27± 0.01*	0.26± 0.01*	0.26± 0.01*	0.28± 0.01
4	0.28± 0.01	0.27± 0.01*	0.26± 0.01*	0.25± 0.01**	0.26± 0.00*	0.27± 0.01*

*Significantly different from base value ($P<0.05$)
**Significantly different from base value ($P<0.01$)
Values with different superscripts differ significantly ($P<0.05$) among the groups

Table 3: Mean ± SE values of total leucocyte count (x109/L) in different groups at different intervals

Sl No	Total leucocyte count (x109/L)					
	0 min	15 min	30 min	45 min	60 min	90 min
1	41.08± 1.72	39.67± 1.85**	39.95± 1.71*	39.57± 2.14*	39.32± 1.83*	39.70± 1.53
2	43.52± 2.41	42.09± 2.42*	41.85± 2.65*	41.67± 2.41*	41.95± 2.17*	41.37± 2.45*
3	41.46± 1.21	39.78± 1.30**	38.58± 1.05**	38.73± 1.31*	38.08± 1.57*	38.63± 1.46*
4	43.43± 1.75	41.64± 2.01**	40.83± 2.22*	40.73± 1.90**	42.33± 1.50	42.57± 2.34

*Significantly different from base value ($P<0.05$)
**Significantly different from base value ($P<0.01$)
Values with different superscripts differ significantly ($P<0.05$) among the groups

Table 4: Mean ± SE values of neutrophil count (%) in different groups at different intervals

S. No	Neutrophil Count (%)					
	0 min	15 min	30 min	45 min	60 min	90 min
1	90.67±1.09	91.50± 1.57	93.50± 1.69**	92.83± 1.38	93.17± 1.38	91.50± 1.18
2	91.50± 1.23	92.83± 1.01	93.00± 0.58	92.83± 1.11	94.17± 1.08	93.17± 1.08
3	89.67± 1.69	90.83± 1.05	93.50± 1.06*	93.67± 0.49*	93.50± 1.06*	92.50± 0.67*
4	91.33± 1.43	91.67± 1.56	93.33± 1.20*	91.67± 1.43	92.33± 1.36	92.50± 1.26

*Significantly different from base value ($P<0.05$)
**Significantly different from base value ($P<0.01$)
Values with different superscripts differ significantly ($P<0.05$) among the groups

Table 5: Mean ± SE values of lymphocyte count (%) in different groups at different intervals

S. No	Lymphocyte Count (%)					
	0 min	15 min	30 min	45 min	60 min	90 min
1	6.33±1.09	5.17± 1.28	3.67± 1.20**	3.83± 0.98*	4.67± 1.15	5.50± 0.76
2	5.83± 0.95	4.33± 0.71*	3.83± 0.54*	3.67± 0.42*	3.83± 0.48*	5.33± 0.56
3	6.83± 1.54	5.67± 0.95	4.33± 0.95*	3.83± 0.70*	4.33± 0.80*	6.33± 0.80
4	5.67± 1.26	5.50± 1.06	4.17± 0.87	4.83± 1.19	5.17± 0.60	5.83± 0.60

*Significantly different from base value ($P<0.05$)
**Significantly different from base value ($P<0.01$)
Values with different superscripts differ significantly ($P<0.05$) among the groups

Table 6: Mean ± SE values of plasma glucose (mmol/L) in different groups at different intervals

S. No	Plasma Glucose (mmol/L)					
	0 min	15 min	30 min	45 min	60 min	90 min
1	5.17± 0.37	5.88± 0.38*	6.21± 0.37**	6.30± 0.30**	6.25± 0.41**	6.24± 0.26**
2	5.30± 0.32	5.59± 0.33	5.86± 0.28*	5.91± 0.47	6.18± 0.43	6.33± 0.27*
3	5.79± 0.32	5.89± 0.26	6.32± 0.37	6.20± 0.36	5.92± 0.35	6.01± 0.37
4	5.99± 0.42	6.12± 0.45	6.25± 0.44	6.77± 0.51	6.59± 0.35*	6.45± 0.50

*Significantly different from base value ($P<0.05$)
**Significantly different from base value ($P<0.01$)
Values with different superscripts differ significantly ($P<0.05$) among the groups

Table 7: Mean ± SE values of plasma urea nitrogen (mmol/L) in different groups at different intervals

S. No	Plasma Urea Nitrogen (mmol/L)					
	0 min	15 min	30 min	45 min	60 min	90 min
1	7.79±0.48	8.06± 0.50	8.40± 0.48**	8.34± 0.52**	8.39± 0.50**	7.88± 0.42
2	7.99± 0.46	8.13± 0.48	8.20± 0.57	8.29± 0.40*	8.22± 0.47	8.01± 0.48
3	7.68±0.53	7.93± 0.41	8.29± 0.50*	8.26± 0.69	8.10± 0.30	8.09± 0.48
4	7.99± 0.50	8.19± 0.45	8.41± 0.63	8.49± 0.51	8.35± 0.44	8.39± 0.32

*Significantly different from base value ($P<0.05$)
**Significantly different from base value ($P<0.01$)
Values with different superscripts differ significantly ($P<0.05$) among the groups

Table 8: Mean ± SE values of plasma creatinine (µmol/L) in different groups at different intervals

S. No	Plasma Creatinine (µmol/L)					
	0 min	15 min	30 min	45 min	60 min	90 min
1	119.40± 8.99	130.83± 9.02**	136.62± 9.44**	145.61± 9.27ab**	140.31± 8.50**	137.66±7.50**
2	124.49± 9.09	140.15± 7.68**	146.42± 7.85**	155.98± 6.78b**	139.66± 6.11**	139.16±6.17
3	117.22± 8.53	125.62± 9.44*	135.44± 10.29*	135.34± 8.69ab*	131.70± 8.97*	123.33±8.55
4	117.59± 5.59	121.91± 7.44	134.01± 7.32**	124.26± 9.24a	127.89± 9.38	119.42±9.08

*Significantly different from base value ($P<0.05$)
**Significantly different from base value ($P<0.01$)
Values with different superscripts differ significantly ($P<0.05$) among the groups

Table 9: Mean ± SE values of oxygen saturation of haemoglobin (%) in different groups at different time intervals

S. No	Oxygen saturation of haemoglobin (%)							
	0 min	15 min	30 min	45 min	60 min	90 min	0 min	15 min
1	89.50±1.67	82.67±1.65**	81.17±1.97b*	79.83±0.70**	79.17±2.23**	80.33±2.29*	84.50±1.20b*	86.67±1.50*
2	90.67± 0.95	81.17±1.17**	80.83±1.97ab**	78.33±1.74**	80.83±2.02**	80.67±2.17**	77.83±0.87a**	84.83±1.72**
3	91.50± 1.06	84.83±1.83**	81.50±1.54b**	80.17±1.89**	78.33±1.45**	80.67±1.28**	83.33±2.30b**	84.67±2.04**
4	89.83± 1.42	81.67±2.29**	75.33±1.96a**	75.50±1.65**	78.83±1.64**	81.33±1.31**	82.17±1.99ab**	87.67±1.26

*Significantly different from base value ($P<0.05$)
**Significantly different from base value ($P<0.01$)
Values with different superscripts differ significantly ($P<0.05$) among the groups

Conclusion

Based on the present study, following conclusions were drawn: Dexmedetomidine (10µg/kg) in combination with butorphanol (0.2 mg/kg) induces good muscle relaxation, analgesia and sedation in canine patients. Dexmedetomidine-butorphanol combination has more dose sparing effect on ketamine used for induction and maintenance of anaesthesia as compared to xylazine-butorphanol/pentazocine premedication in canine patients. Dexmedetomidine-butorphanol combination produced a comparable degree of haemodynamic stability during ketamine anaesthesia in dogs undergoing ovariohysterectomy following pyometra and may be recommended for balanced anaesthesia.

References

1. Ahmad RA. Studies on sedative, analgesic and anaesthetics effects of dexmedetomidine and its combination with midazolam, fentanyl and ketamine in dogs. M.V.Sc. Thesis submitted to Deemed University, Indian Veterinary Research Institute, Izatnagar (U.P.), India, 2010.
2. Bhannaria S, Bhargava MK, Pandey SK, Kushwaha A. Biochemical effects of epidural centbucridine with xylazine or pentazocine in dogs. Indian J. Vet. Surg. 2005; 26(1):45-46.
3. Chandrashekarappa M, Ananda KJ. Evaluation of anaesthetic combinations of propofol with pentazocine lactate and chloramphenicol in dogs. Indian Vet. J. 2009; 86:577-579.
4. Chonde MS, Tiwari SK, Shinkar DS, Sharda R. Cardiopulmonary effects of medetomidine and diazepam in ketamine anaesthetized dogs. Indian Vet. Med. J. 2004; 28(2):188-190.
5. Fox SM, Mellor DJ, Stafford KJ, Lowoko CRO. The effects of ovariohysterectomy plus different combinations of halothane anaesthesia and butorphanol analgesia on behaviour in the bitch, Research in Veterinary Science. 2000; 68:265-274.
6. Kinjavdekar P, Singh GR, Amarpal Aithal HP, Pawde AM. Physiologic and biochemical effects of subarachnoidally administered xylazine and medetomidine in goats. Small Rum. Res. 2000; 38:217-228.
7. Lemke KA. Perioperative use of selective alpha-2 agonists and antagonists in small animals, Canadian Veterinary Journal. 2004; 45:475-480.
8. Leppanen MK, McKusick BC, Granholm MM, Westerholm FC, Tulama R, Short CE. Clinical efficacy and safety of dexmedetomidine and buprenorphine, butorphanol or diazepam for canine hip radiography. J. Small Anim. Pract. 2006; 47:663-669.
9. Malik V, Kinjavdekar P, Amarpal Aithal HP, Pawde AM, Surbhi. Sedative, analgesic, cardiopulmonary and haemodynamic effects of medetomidine-butorphanol and midazolam-butorphanol on thiopental-propofol anaesthesia in water buffaloes (Bubalusbubalis). J App. Anim. Res. 2011; 39:284-287.
10. Mirakhur KK, Sobti VK, Nigam JM. Effect of thiopentone anaesthesia in plasma cortisol in buffalo calves. Indian J. Vet. Surg. 1984; 3:86.
11. Monsang SW. Comparison of medetomidine and dexmedetomidine with and without butorphanol and midazolam as preanaesthetics to propofol anaesthesia in sheep. Ph.D. Thesis submitted to Deemed University, Indian Veterinary Research Institute, Izatnagar, (U.P.), India, 2011.
12. Muir WW, III, Ford JL, Karpa GE, Harrison EE, Gadawski JE. Effects of intramuscular administration of low doses of medetomidine and medetomidine-butorphanol in middle-aged and old dogs, Journal of American Veterinary Medical Association. 1999; 215:1116-1120.
13. Nowrouzian I, Schels HF, Ghodsian I, Karimi H. Evaluation of the anaesthetic properties of ketamine and ketamine/xylazine/atropine combination in sheep. Vet. Rec. 1981; 108:354-356.
14. Pretzer SD. Clinical presentation of canine pyometra & mucometra: A review in Theriogenology. 2008; 70:359-363.
15. Rafee MA. Evaluation of midazolam and ketamine anaesthesia for ovariohysterectomy in dexmedetomidine with or without butorphanol/pentazocine premedicated dogs. M.V.Sc. Thesis submitted to Deemed University, Indian Veterinary Research Institute, Izatnagar, (U.P.), India, 2013.
16. Santhosh KM. Evaluation of dexmedetomidine as preanaesthetic to ketamine anaesthesia in midazolam or midazolam-fentanyl premedicated dogs. M.V.Sc. Thesis submitted to Deemed University, Indian Veterinary Research Institute, Izatnagar, (U.P.), India, 2011.
17. Siegel Sand Jr. Castellan NJ. Non parametric Statistics for the behavioural Sciences. 2nd edn., McGraw-Hill book Company, New York, 1988.
18. Sika PK. Evaluation of butorphanol along with xylazine or dexmedetomidine as preanaesthetic to ketamine or propofol anaesthesia in canine patients. M.V.Sc. Thesis submitted to OUAT, Bhubaneswar, India, 2013.
19. Singh GD. Comparative evaluation of halothane and isoflurane inhalation anaesthesia in buffaloes. Ph.D. Thesis submitted to Deemed University, Indian Veterinary Research Institute, Izatnagar, (U.P.), India, 2011.
20. Surbhi Kinjavdekar P, Amarpal Aithal HP, Pawde AM, Pathak MC, Borena BM. Physiological and biochemical effects of medetomidine-butorphanol-propofol anaesthesia in dogs undergoing orthopaedic surgery. Indian J Vet. Surg. 2010; 31(2):101-104.
21. Snedecor G, Wand Cochran WG. Statistical Methods. 9thedn.Iowa state university press, 1980.
22. Thurmon JC, Short CE. History and overview of veterinary anesthesia. In: Tranquilli WJ, Thurmon JC, Grimm KA. (eds). Lumb & Jones' Veterinary Anesthesia and Analgesia. 4th ed, Blackwell Publishing Ltd, Oxford, 2007, 3-6.
23. Tripathi KD. Essentials of Medical Pharmacology, 4th edn. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, India, 1999.
24. Wagner AE, Hitchcliff KW. Cardiovascular effects of xylazine and detomidine in horses. Am. J Vet Res. 1991; 52:651-657.
25. White PH. Use of continuous infusion versus intermittent bolus administration of fentanyl or ketamine during outpatient anaesthesia, Anaesthesiology, 1983; 59:294-300.