International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; 9(12): 105-110
www.biochemjournal.com
Received: 18-10-2025
Accepted: 22-11-2025

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Comparative evaluation of hematobiochemical parameters in cats receiving intramuscular atropine-tiletamine-zolazepam and dexmedetomidine-ketamine-butorphanol anaesthetic combinations

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DOI: https://www.doi.org/10.33545/26174693.2025.v9.i12b.6448

Abstract
Ovariohysterectomy is one of the most common operative procedures performed in female cats. In present clinical study twelve (N=12) non-descript female cats were divided in two equal groups regardless of age and body weight to evaluate various haematobiochemical parameters. Cats in group I were anaesthetized using single intramuscular administration of Atropine-Tiletamine-Zolazepam (A-TZ) whereas cats of group II were anaesthetized using Dexmedetomidine-Butorphanol-Ketamine (DBK) intramuscularly and each cat operated for elective ovariohysterectomy. Blood samples were taken before anaesthesia, 10 minutes after anaesthesia, 30 minutes after anaesthesia and after recovery of anaesthesia to evaluate hematobiochemical parameters. Statistically significant reduction was noted in values of Hb and PCV in group I; while group II showed statistically significant changes in TEC, PCV, Platelet and serum creatinine. However, various haemato-biochemical parameters in present study fluctuated throughout the observation period but remained within normal reference limits. Based on present clinical study it was concluded that atropine-tiletamine-zolazepam and dexmedetomidine-butorphanol-ketamine administrated safely in cats.

Keywords: Atropine-Tiletamine-zolazepam, Anaesthesia, Cats, Dexmedetomidine-Butorphanol-ketamine, Hematobiochemical parameters, Intramuscular, Ovariohysterectomy

Introduction
Tiletamine is a dissociative anaesthetic twice as potent as ketamine and has longer duration of action (Lin *et al*., 1993) [10]. Tiletamine is used in combination with zolazepam in 1:1 ratio, when latter combined with tiletamine, it reduces muscle rigidity, myoclonus and seizure activity, allows reduction of dosage of tiletamine required to produce sedation and anaesthesia (Forsyth, 1995). Terminal half-life of tiletamine is 2.5 hours in cats and 1.2-1.3 hours in dogs while that of zolazepam is longer in cats (4.5 hours) compared to dogs (< 1 hour), (Lin *et al*., 1993) [10]. Zolazepam has longer elimination half-life than that of tiletamine in cats hence, it provides long-lasting tranquilizing effects to balance potentially rough recovery effects due to dissociative anaesthesia, thus causing a smoother recovery in cats compared to dogs, hence tiletamine and zolazepam is commonly used in feline patients.

Alpha-2-agonists such as dexmedetomidine provide reliable sedation and short-term analgesia, hence are a widely used group of sedatives in feline medicine (Cullen and Reynoldson, 1997; Nagore *et al*., 2013) [4, 12]. It is a common practice to combine alpha-2-agonists in low doses (Ossipov *et al*., 1990) [14] with opioids for achieving good sedation and synergistic analgesia (Selmi *et al*., 2003; Slingsby and Taylor, 2008) [16, 18]. Ketamine is often used to combine with opioids and alpha-2-agonists because of its high bioavailability, rapid absorption, short onset of action, analgesia and amnesia after IM administration (Kohrs and Durieux, 1998) [9] and has been found to have increased duration of anaesthesia when combined with dexmedetomidine and butorphanol (Selmi *et al*., 2003) [16].

An intramuscular anaesthetic protocol renders obvious benefits in small veterinary clinical facilities with limited availability of anaesthetic equipment.

Moreover, fractious nature of some cats, adds-on to the reason for devising an anaesthetic protocol that is well absorbed via IM route, is required small amounts and offers reliable sedation. To date, several intramuscular anaesthetic combinations were studied Wycislo *et al.* (2014) [21], Biermann *et al*. (2012) [3], Spada *et al*. (2014) [19], Volpato *et al*. (2015) [20] in cats to assess their effect on hematobiochemical parameters. The purpose of this study is to compare and evaluate safety of Atropine-Tiletamine-Zolazepam and Dexmedetomidine-Butorphanol-Ketamine on various haematobiochemical indices in cats after intramuscular administration.

Materials and Methods

The present study was performed on twelve (N=12) female cats of non-descript origin, presented for elective ovariohysterectomy. These cats, irrespective of age and body weight were randomly allotted in Group I (A-TZ; Atropine-Tiletamine-Zolazepam) and Group II (DBK; Dexmedetomidine-Butorphanol-Ketamine) each consisting six cats named (TZ-1, TZ-2….and so on upto DKB-6) to evaluate haematobiochemical indices. Detail dose rate of each drug used in present study are depicted in table 1. Preanaesthetic evaluation in all feline patients were carried out 12-24 hours prior to administration of pre-anaesthetic/anaesthetic drugs by assessing detailed history, physical examination, haematology, blood biochemistry and only apparently healthy cats were included in the present study. To evaluate hematobiochemical parameters approximately 1.5 ml of venous blood sample were taken before anaesthesia (12-24 hours prior to administration of pre-anaesthetic/anaesthetic drug), 10 minutes after anaesthesia, 30 minutes after anaesthesia and after recovery from anaesthesia. All blood samples were processed within 90 minutes of collection in human pathology laboratory. At each time point, following haematological and biochemical parameters were analyzed: Haemoglobin (g/dl); Total Erythrocyte Count (TEC) (10^6/cu.mm); Packed Cell Volume (PCV) (%); Mean Corpuscular Volume (MCV) (fl); Mean Corpuscular Haemoglobin (MCH) (pg); Mean Corpuscular Haemoglobin Concentration (MCHC) (%); Total Leucocyte Count (TLC) (per cu.mm); Differential Leucocyte Count (DLC) (%); Platelet count (Plt) (10^5/cu.mm); Total Bilirubin (mg/dL); Serum Glutamic Oxaloacetic Transaminase (SGOT/AST) (U/L); Serum Glutamic Pyruvic Tranasminase (SGPT/ALT) (U/L); Alkaline Phosphatase (ALP) (U/L); Total protein (g/dL); Serum Albumin (g/dL); Serum Globulin (g/dL); Blood urea nitrogen (mg/dL); Serum creatinine (mg/dL). All haemato-biochemical assessments were recorded into the medical record of each cat. (Figure 1).

The haematobiochemical data were collected and analyzed using two-way repeated measure ANOVA with terms for the group, time period, and their interactions using R program (2020) software (version 3.6.3) to know the effect of different treatment groups at different time points.

Table 1: Detail dose of anaesthetic drug used in present study

Groups	Anaesthetic drugs		Dose rate and route of administration
Group I A-TZ, (N=6)	Inj. Atropine sulphate @ 0.04mg/Kg SC	(15 minutes later) Inj. Tiletamine + Zolazepam	14.5 mg/Kg BW (IM)
Group II DKB, (N=6)	Inj. Dexmedetomidine Hydrochloride + Inj. Ketamine Hydrochloride + Inj. Butorphanol tartrate		25 µg/Kg BW + 5 mg/Kg BW + 0.5 mg/Kg BW (IM)

Results and Discussion

Patient signalment and Body condition score

The present study was conducted on female cats of non-descript origin. The average age of cats involved was 2.00±0.58 years Group I and 2.75±0.73 years in group II, with a range of 6 months to 4 years and 10 months to 6 years, respectively. Howe (2015) has discussed about several evidences suggesting that gonadectomy is safe in cats following 6 weeks of age.

Body weight of cats was found to lie in the range of 1.95 to 4.3 Kgs for group I and 2.55 to 4.2 Kgs for group II, average being 3.34±0.34 Kgs and 3.16±0.28 Kgs, respectively. The age and body weight of cats included in the study did not differ significantly within or between groups.

Body Condition Score (BCS) was measured using a 5-point scale for each cat. There was no statistically evident difference in BCS scores of cats within and between groups (Average BCS score was 3/5).

Haemoglobin

Baseline haemoglobin values were 12.2±0.75 and 11.95±0.71 g/dl for groups I and II, respectively (Table 2). The haemoglobin values did not differ significantly between groups. However, significant changes were evident within group I (A-TZ) over time (p<0.05) and the lowest values were recorded at 30 minutes (Table 2). This finding was agreement with results obtained by Zlateva *et al.* (2015) [22], where cats undergoing ovariohysterectomy had lowest haemoglobin value recorded at 30 minutes after administration of xylazine-ketamine (X/K), Propofol (In) and Acepromazine and butorphnol (MM) groups.

Total Erythrocyte Count (TEC)

Total erythrocyte count before administration of anaesthesia were 8.57±0.56 and 8.5±0.58 10^6/cu.mm for group I and group II, respectively (Table 2). Group I did not show significant changes; however, group II exhibited a significant fall in TEC count over time (p<0.01), (Table 1). Lu *et al*. (2012), Reynolds *et al*. (2012) [15] and Spada *et al*. (2014) [19] reported decrease in RBC count alike in present study.

On the other hand, Volpato *et al*. (2015) [20] did not encounter any change in red blood cell count of cats restrained physically and chemically using dexmedetomidine-butorphanol with or without ketamine but mentioned that high baseline values could be a result of splenic contraction in response to release of catecholamines due to stress while physical restraint in awake cats. Haemodynamic variations causing reduction of RBC might be caused by decrease in plasma concentration of catecholamines causing splenic dilatation and RBC sequestration.

Packed cell volume (PCV)
Packed cell volume was found to differ significantly within both groups over time but no statistical changes were evident between groups. Lowest PCV values of 29.43±3.06 and 23.83±2.17 percentage were noted after recovery in groups I and II, respectively (Table 2). Reynolds *et al*. (2012) [15] reported significant decrease whereas Spada *et al*. (2014) [19] and Sethi *et al*. (2017) [17] reported insignificant decrease of PCV in cats. No significant difference was noted by Volpato *et al*. (2015) [20] in PCV of cats restrained physically and chemically using dexmedetomidine-butorphanol with or without ketamine. However, higher PCV during physical restraint may be due to stress related release of catecholamines causing splenic contraction while, lower values following sedation could be caused due to decrease of catecholamine response leading to splenic dilation.

Mean Corpuscular Volume (MCV)
Mean corpuscular volume is the average volume of red blood cells. Baseline mean ± SE values for mean corpuscular volume were 47.98±3.79 and 43.83±2.44 femtoliters (fl) in group I and group II, respectively (Table 2). MCV was found to differ significantly between groups (p<0.01) at 10 minutes post induction, however no variation was noted within Group over time. Reynolds *et al*. (2012) [15] demonstrated an increase in MCV however, Biermann *et al*. (2012) [3] and Volpato *et al*. (2015) [20] found no significant changes in MCV of cats with use of various IM anaesthetic protocols.

Mean Corpuscular Haemoglobin (MCH)
Mean corpuscular haemoglobin values quantifies the amount of haemoglobin per red blood cell. Baseline MCH values had an average of 14.33±0.63 and 14.12±0.17 picograms (pg) in group I and group II, respectively (Table 2). No statistically evident difference was noted between groups or within group over time. As noticed in present study, Biermann *et al*. (2012) [3] and Volpato *et al*. (2015) [20] reported no significant changes in MCH of cats with use of various IM anaesthetic protocols.

Mean Corpuscular Haemoglobin Concentration (MCHC)
Mean corpuscular haemoglobin concentration indicates amount of haemoglobin per unit volume. MCHC values at baseline were 30.38±1.61 and 32.68±1.63 percentage and did not fluctuate significantly within groups (Table 2). However, the values at 10 minutes and 30 minutes differed significantly between groups (p<0.01). Nevertheless, none of the cats exhibited variation in MCHC values over time (p>0.05) similar to findings from Reynolds *et al*. (2012) [15].

Total Leucocyte count (TLC), (per cumm)
Total leucocyte counts were found to be considerably higher than the normal reference range defined in cats as observed by O'Brien *et al*. (1998) [13] and these values fluctuated throughout the study between groups and within groups over time, but the fluctuations were not statistically significant (Table 2). However, the samples were processed in a human pathology laboratory which might also be a reason for variation in counts of certain parameters. Reynolds *et al*. (2012) [15] reported significant decrease whereas Spada *et al*. (2014) [19] observed statistically insignificant decrease similar to present study.

Differential Leukocyte Count (DLC)
The counts of neutrophils, lymphocytes, monocytes, eosinophils and basophils wavered within reference limits throughout the study; however, significant changes were observed only for monocytes with differences within group I over time (Table 3). Insignificant decrease was noted in lymphocytes, monocyte and eosinophils however neutrophils were found to increase. Reynolds *et al*. (2012) [15] found significant fall in neutrophil count whereas Spada *et al*. (2014) [19] reported statistically insignificant decrease in neutrophil and monocyte count while an increase in eosinophil, basophils and lymphocyte count. Sethi *et al*. (2017) [17] reported a non-significant increase in neutrophil count similar to present study.

Platelets
Platelet counts were found to be considerably low than normal in both groups at baseline which could be due to analysis in automated analyser machine which fails to recognize clumping leading to lower count values as observed by O'Brien *et al*. (1998) [13]. The platelet counts deviated from baseline being lowest at 30 minutes but this change was not statistically significant (P>0.05) (Table 2). The platelets increased from baseline values within group I but significant variation was noted only in group II, where platelets significantly decreased from baseline at all time periods. These findings were in alignment with studies performed by Reynolds *et al*. (2012) [15] and Spada *et al*. (2014) [19].

Total bilirubin
Total bilirubin values were 0.52±0.03 mg/dl and 0.47±0.04 mg/dl for group I and group II, respectively (Table 2). No significant differences were observed between groups. Total bilirubin was found to be highest after recovery but this deviation was insignificant statistically. Corresponding findings were noted by Reynolds *et al*. (2012) [15].

Serum Glutamic-Oxaloacetic Transaminase or Aspartate aminotransferase (SGOT/AST)
SGOT/AST is an enzyme normally present in liver and heart cells and released in circulation in high quantities when liver or heart is damaged. In present study, an overall significant alteration was noted between groups (p<0.01), (Table 2). SGOT values were found to increase gradually towards recovery within groups over time, but this variation was not statistically significant. Reynolds *et al*. (2012) [15] found decrease in AST values whereas Lu *et al*. (2012) reported initial decrease in AST value of pigs which gradually normalized over 24 hours. Biermann *et al*. (2012) [3] reported increase in AST levels using various IM anaesthetic combinations similar to present study.

Serum Glutamic Pyruvic Transaminase or Alanine aminotransferase (SGPT/ALT)
SGPT is an enzyme found particularly in liver and released into circulation following liver injury. In present study, SGPT was found to have an overall significant variation between groups (p<0.05), however it was statistically insignificant within groups over time, even though SGPT values were noted to be highest in group I and lowest in

group II at 10 minutes than at any other time period (Table 2). Lu *et al*. (2012) reported initial decrease however, Reynolds *et al*. (2012) [15] reported a non-significant increase in ALT values analogous to present study. Barasona *et al*. (2013) [2] reported negative correlation between dose and ALT activity demonstrating a decrease in ALT concentration after increasing the dose of anaesthesia.

Alkaline Phosphatase (ALP)

ALP is an enzyme normally found in liver, kidney, digestive system and bones. It is released into bloodstream on affection of either of the mentioned system. ALP was found to be highest after recovery in group I but at only 30 minutes in group II. No significant changes were noted within groups or between groups over time (p>0.05) (Table 2). Reynolds *et al*. (2012) [15] reported initial decrease in ALP values. None of the studies reported findings alike present study except for Lu *et al*. (2012) where an initial decrease was followed by increase in ALP, however the values at recovery were higher than baseline values; although this finding cannot be compared to their findings as no blood analysis was performed at 24-hour time period in the present study.

Serum Protein

Serum protein levels were not affected significantly on administration of both anaesthetic combinations (Table 2). No statistically evident changes were noted within groups over time similar to Biermann *et al*. (2012) [3] however contrasting findings were noted by study conducted by Reynolds *et al*. (2012) [15] illustrating a mean decrease in serum protein post IV anaesthetic administration.

Serum albumin

Albumin levels in serum were found to have an overall significant difference between groups (p<0.05), (Table 2). Although the values fluctuated throughout the study period, there was no significant change observed within groups over time; however, Reynolds *et al*. (2012) [15] reported a significant decrease in albumin levels.

Serum globulin

An overall significant variation in serum globulin was observed between groups (p<0.05), (Table 2). Although the globulin values were noted to be highest at 30 minutes within both groups, this deviation was not evident statistically.

Blood Urea Nitrogen (BUN)

Blood urea nitrogen levels fluctuated throughout the study with increase followed by decrease in group I and consistent decrease in group II but no statistically significant changes were noted between groups or within groups over time (p>0.05), (Table 2). Alike present study, Aminkov *et al*. (2018) observed increased BUN after induction in brown bears while, Sethi *et al*. (2017) [17] encountered an increase in plasma urea nitrogen values of dogs which was insignificant except at 30 minutes.

Table 2: Mean ± SE values of Haematobiochemical parameters in cats of groups I and II

Parameters	Groups	Time				P-Value		
		Before anaesthesia	10 min after anaesthesia	30 min after anaesthesia	After recovery	Group	Time	G*T
Haemoglobin (g/dl)	I	12.2±0.75^{b}	9.67±0.83^{a}	9.4±0.82^{a}	10.02±0.55^{ab}	0.578	0.019	0.459
	II	11.95±0.71	11.38±1.35	10.05±1.18	9.22±0.74			
TEC count (10^6/cu.mm)	I	8.57±0.56	6.78±0.82	6.73±0.72	6.75±0.58	0.788	0.002	0.461
	II	8.5±0.58^{b}	7.88±0.96^{ab}	6.68±0.66^{ab}	6.17±0.6^{a}			
PCV (%)	I	41±4.32^{b}	29.8±2.86^{a}	29.93±2.33^{a}	29.43±3.06^{a}	0.167	0.001	0.775
	II	36.95±2.75^{b}	30.4±3.89^{ab}	26.75±3.63^{a}	23.83±2.17^{a}			
MCV (fl)	I	47.98±3.79	45.82±2.57^{A}	45.53±2.5	44.95±4.46	0.004	0.426	0.941
	II	43.83±2.44	38.92±2.55^{B}	40.62±2.6	40.33±1.29			
MCH (pg)	I	14.33±0.63	14.77±1.13	14.12±0.63	15.22±1.3	0.405	0.913	0.33
	II	14.12±0.17	14.57±0.61	14.73±0.51	13.53±0.39			
MCHC (g/dl)	I	30.38±1.61	32.3±0.78^{A}	31.22±1.14^{A}	34.28±2.45	0.001	0.066	0.326
	II	32.68±1.63	37.02±0.9^{B}	36.87±1.23^{B}	35.47±1.73			
(TLC) (/cu.mm)	I	20716.67±4650.69	21216.67±4248.64	14416.67±5238.47	19016.67±6653.59	0.203	0.575	0.904
	II	18016.67±4799.68	15916.67±3732.06	13166.67±3331.33	11433.33±2631.69			
Platelet count (10^5/cu.mm)	I	0.89±0.2	0.81±0.14	0.9±0.21	1.05±0.21	0.010	0.246	0.121
	II	0.99±0.18	0.62±0.08	0.53±0.08	0.58±0.06			
Total bilirubin (mg/dl)	I	0.52±0.03	0.51±0.05	0.5±0.03	0.54±0.07	0.615	0.568	0.449
	II	0.47±0.04	0.52±0.03	0.58±0.06	0.57±0.05			
SGOT (U/L)	I	41.7±6.47	46.65±5.41	45.48±5.39	48.19±6.88	0.005	0.382	0.968
	II	27.38±6.13	35.77±5.35	35.43±6	38.67±8.03			
SGPT (U/L)	I	58.88±17.9	69.07±17.88	59.47±13.79	62.85±14.31	0.013	0.995	0.701
	II	50.63±12.07	42.97±2.79	48.67±4.32	48.1±5.41			
ALP (U/L)	I	76.28±4.24	74.7±2.73	76.62±2.43	78.52±4.67	0.271	0.764	0.931
	II	69.45±7.65	71.67±3.45	75.73±3.28	74.92±5.43			
Serum Protein (g/dl)	I	5.83±0.1	5.87±0.06	5.98±0.18	5.88±0.13	0.710	0.511	0.311
	II	6.22±0.46	5.62±0.11	5.75±0.18	5.78±0.07			
Serum albumin (g/dl)	I	3.83±0.08	3.83±0.08	3.72±0.07	3.82±0.06	0.015	0.419	0.571
	II	4.23±0.26	3.85±0.12	4.02±0.16	4±0.08			
Serum globulin (g/dl)	I	2.02±0.14	2.07±0.11	2.27±0.21	2.05±0.1	0.071	0.442	0.797
	II	2±0.24	1.78±0.17	2.02±0.14	1.83±0.1			
BUN (mg/dl)	I	14.93±0.64	15.54±0.95	15.21±1.04	14.66±0.93	0.288	0.764	0.591
	II	15.64±1.12	13.72±0.63	14.17±1.03	13.95±1.23			
Serum creatinine (mg/dl)	I	1.28±0.06	1.25±0.08	1.36±0.11	1.3±0.11	0.02	0.499	0.453
	II	1.28±0.04^{b}	1.16±0.07^{ab}	1.18±0.06^{ab}	1.08±0.05^{b}			

Table 3: Mean ± SE values of different leukocyte count in cats of groups I and II

DLC	Groups	Time				P-Value		
		Before anaesthesia	10 min after anaesthesia	30 min after anaesthesia	After recovery	Group	Time	G*T
Neutrophils	I	31.83±4.71	37.83±5.17	35.17±8.34	39.83±5.52	0.24	0.89	0.41
	II	40.67±2.67	40.67±2.42	40.5±2.7	35.83±3.89			
Lymphocytes	I	62.5±5.14	58.67±5.17	60±8.21	55.5±5.22	0.24	0.92	0.26
	II	53.5±2.46	53.33±2.56	54.5±3.22	61.83±3.94			
Monocytes	I	3.83±0.4	2.5±0.34	3.17±0.4	3.17±0.48	0.55	0.25	0.15
	II	3.5±0.43	3.67±0.42	3.5±0.56	2.67±0.33			
Eosinophils	I	1.83±0.31	1.33±0.21	1.67±0.33	1.5±0.22	0.15	0.4	0.65
	II	2.33±0.56	2.17±0.4	2.17±0.6	1.33±0.21			
Basophils	I	0±0	0±0	0±0	0±0	-	-	-
	II	0±0	0±0	0±0	0±0			

HAEMATO-BIOCHEMICAL PARAMETER PROFORMA

Date: **Case No:** **Group:** **Owner name:**

Patient Name: **Age:** **Colour:** **Body weight:**

	Before induction	10 min after induction	30 min after induction	After recovery	Reference values*
Complete Blood Count (CBC)					
Hb					8 – 15.4 (g/dL)
TEC					5 – 10 (x 10^6/µL)
PCV/ HCT					24 – 45 (%)
MCV					39 – 55 (fL)
MCH					13 – 17 (pg)
MCHC					30 – 36 (%)
RDW					
TLC					5,500–19,500 (/µL)
Neutrophils					45 – 64 (%)
Lymphocytes					27 – 36 (%)
Monocytes					0 – 5 (%)
Eosinophils					0 – 4 (%)
Basophils					0 – 1 (%)
Plt					3 – 8 (x10^5/ µL)
Liver Function Test (LFT)					
Total bilirubin					0 – 0.1 (mg/dL)
D. bilirubin					
I.bilirubin					
S.G.O.T.					7 – 38 (U/L)
S.G.P.T.					25 – 97 (U/L)
Alkaline phosphatase					0 – 45 (U/L)
S. Protein					6 – 7.5 (g/dL)
S. Albumin					2.8 – 3.9 (g/dL)
S. Globulin					2.6 – 5.1 (g/dL)
Kidney Function Test (KFT)					
BUN					19 – 34 (mg/dL)
Creatinine					0.9 – 2.2 (mg/dL)

*Reference Values as per Mercks Veterinary Index

Fig 1: Record proforma for noting hematobiochemical values of each cat

Serum creatinine

Serum creatinine values differed significantly between groups ($p<0.05$), (Table 2). The creatinine levels were found to be lowest at 10 minutes within both groups, however statistical evidence of variation within group over time was noted only in group II. Reynolds *et al*. (2012) [15] reported a non-significant decrease of in serum creatinine however, reported contrasting increase in serum creatinine values during initial 10 minutes which normalized over 24 hour observation period. Sethi *et al*. (2017) [17] observed increase in creatinine values of dogs that were significant from 15 to 60 minutes and non-significant from 90 minutes later on.

Conclusion

Single intramuscular administration of atropine-tiletamine-zolazepam and dexmedetomidine-butorphanol-ketamine in cats did not produce any adverse effect on various haemato-biochemical parameters in present study and fluctuated throughout the study but remained within normal reference limits. From the present study, it was concluded that atropine-tiletamine-zolazepam and dexmedetomidine-butorphanol-ketamine safely administrated in cats without any adverse effect on haematological and serum biochemical parameters.

References

1. Aminkov B, Mehandzhiyski N, Aminkov K, Peev I. Effects of total intravenous anaesthesia on hematology and biochemistry values during health check in brown bears (*Ursos arctos*). Tradit Mod Vet Med. 2018;3(2):94-9.
2. Barasona JA, Olvera LJR, Beck BB, Gortázar C, Vincente J. Trap-effectiveness and response to tiletamine-zolazepam and medetomidine anaesthesia in Eurasian wild boar captured with cage and corral traps. BMC Vet Res. 2013;9:107-17.
3. Biermann K, Hungerbühler S, Mischke R, Kästner SBR. Sedative, cardiovascular, hematologic and biochemical effects of four different drug combinations administered intramuscularly in cats. Vet Anaesth Analg. 2012;39:137-50.
4. Cullen LK, Reynoldson JA. Effects of tiletamine/ zolazepam premedication on propofol anaesthesia in dogs. Vet Rec. 1997;140:363-6.
5. Forsyth S. Administration of a low dose tiletamine-zolazepam combination to cats. N Z Vet J. 1995;43(3):101-3.
6. Hanna RM, Borchard RE, Schmidt SL. Pharmacokinetics of ketamine HCl and metabolite I in the cat: A comparison of I.V., I.M., and rectal administration. J Vet Pharmacol Ther. 1988;11:84-93.
7. Howe LM. Current perspectives on the optimal age to spay/castrate dogs and cats. Vet Med Res Rep. 2015;6:171-180.
8. Ko JC, Austin BR, Barletta M, Weil AB, Krimins RA, Payton ME. Evaluation of dexmedetomidine and ketamine in combination with various opioids as injectable anesthetic combinations for castration in cats. J Am Vet Med Assoc. 2011;239(11):1453-1462.
9. Kohrs R, Durieux ME. Ketamine: teaching an old drug new tricks. Anesth Analg. 1998;87:1186-1193.
10. Lin HC, Thurmon JC, Benson GJ, Tranquilli WJ. Telazol: A review of its pharmacology and use in veterinary medicine. J Vet Pharmacol Ther. 1993;16(4):383-418.
11. Lu D, Fan H, Jiang S, Zhang L, Ma K, Yu S, *et al*. Cardio-pulmonary, biochemical and haematological effects of the tiletamine/zolazepam-xylazine-tramadol combination to provide anaesthesia in miniature pigs. J Integr Agric. 2012;11(2):1340-6.
12. Nagore L, Soler C, Gil L, Serra I, Soler G, Redondo JI. Sedative effects of dexmedetomidine, dexmedetomidine -pethidine and dexmedetomidine-butorphanol in cats. J Vet Pharmacol Ther. 2013;36(3):222-8.
13. O'Brien M, Murphy MG, Lowe JA. Hematology and clinical chemistry parameters in the cat (*Felis domesticus*). J Nutr. 1998;128(12 Suppl):2678S-9S.
14. Ossipov MH, Harris S, Lloyd P, Messineo E, Lin BS, Bagley J. Antinociceptive interaction between opioids and medetomidine: Systemic additivity and spinal synergy. Anesthesiology. 1990;73:1227-35.
15. Reynolds BS, Geffre A, Abella BNH, Vaucoret S, Mourot M, Braun JD, *et al*. Effects of intravenous, low-dose ketamine-diazepam sedation on the results of hematologic, plasma biochemical, and coagulation analyses in cats. J Am Vet Med Assoc. 2012;240:287-93.
16. Selmi AL, Mendes GM, Lins BT, Figueiredo JP, Selmi BGR. Evaluation of the sedative and cardiorespiratory effects of dexmedetomidine, dexmedetomidine-butorphanol, and dexmedetomidine-ketamine in cats. J Am Vet Med Assoc. 2003;222:37-41.
17. Sethi S, Singh J, Nath I, Das RK, Nayak S, Sahu RK. Haemato-biochemical comparison of xylazine/ dexmedetomidine in combination with butorphanol/ pentazocine as pre-anaesthetic to ketamine anaesthesia in canine pyometra patients. Pharma Innov J. 2017;6(9):393-9.
18. Slingsby LS, Taylor PM. Thermal antinociception after dexmedetomidine administration in cats: A dose-finding study. J Vet Pharmacol Ther. 2008;31:135-42.
19. Spada E, Proverbio D, DeGiorgi GB, Perego R, Valena E, Pepa DA, *et al*. Clinical and haematological responses of feline blood donors anaesthetized with a tiletamine and zolazepam combination. J Feline Med Surg. 2014;17(4):338-41.
20. Volpato J, Mattoso CRS, Beier SL, Coelho MM, Tocheto R, Kirsten CE, *et al*. Sedative, hematologic and hemostatic effects of dexmedetomidine-butorphanol alone or in combination with ketamine in cats. J Feline Med Surg. 2015;17(6):500-6.
21. Wycislo KL, Connolly SL, Slater MR, Makolinski KV. Biochemical survey of free-roaming cats (*Felis catus*) in New York City presented to a trap-neuter-return program. J Feline Med Surg. 2014;16(8):657-62.
22. Zlateva NZ, Marinov GM. Effect of three anaesthetic protocols on the haematological indices in cats during ovariohysterectomy. J Med Dent Pract. 2015;2(2):184-193.