RESEARCH ARTICLE

Effects of Xylazine and Dexmedetomidine as a Preanaesthetic Agent with Tiletamine-Zolazepam Anaesthesia on Clinico -Haemato-Biochemical Profile in Dogs

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Abstract

The present clinical study assessed the clinico-physiological and haemato-biochemical effects of xylazine and dexmedetomidine as preanaesthetic agents in dogs anaesthetised with tiletamine-zolazepam. A total of 12 dogs were presented for major surgical procedures. They were randomly divided into two groups: Group I received xylazine (@ 1 mg/kg BW, IM) and Group II received dexmedetomidine (@ 0.01 mg/kg BW, IM), followed by intravenous induction with tiletamine-zolazepam (@ 3 mg/kg BW till effect) and maintenance with the same @ one-half of induction dose. Clinico-physiological and haemato-biochemical parameters were recorded before, during and at 15 minutes intervals post-induction. Both anaesthetic protocols maintained cardiovascular and respiratory stability, time-dependent variations observed within groups. No significant differences were noted between groups, indicating well-preserved cardiac function and overall cardiovascular health. Haemato-biochemical parameters showed fluctuations but remained within normal physiological limits confirming adequate hepatic and renal safety.

Key words: Clinico-physiological parameters, Dexmedetomidine, Dogs, Haemato-biochemical parameters, T-Z Anaesthesia, Xylazine.

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Introduction

Anaesthesia is a reversible, controlled depression of the central nervous system that produces unconsciousness, analgesia, muscle relaxation and suppression of reflexes, enabling pain-free surgical and diagnostic procedures in patient (Tranquilli and Grimm, 2015). In veterinary practice, anaesthesia may be achieved using injectable agents, inhalational agents or a combination of both. Total intravenous anaesthesia (TIVA) is increasingly preferred in small animal practice because of its simplicity, reduced equipment dependence and reducing occupational exposure to waste anaesthetic gases (Raffe and Knottenbelt, 2016).

As no single anaesthetic agent can safely provide all desired components of anaesthesia, balanced anaesthesia using combinations of drugs is widely adopted to improve safety and physiological stability while reducing dose-related adverse effects (Grubb and Lobprise, 2020). Preanaesthetic medications reduce stress, enhance analgesia, and facilitate smooth induction and decrease induction and maintenance anaesthetic requirements. Among these, α-adrenergic agonists such as xylazine and dexmedetomidine are commonly used in dogs due to their reliable sedative and analgesic effects, dose-sparing properties and acceptable cardiovascular stability (Murrell and Hellebrekers, 2005). This study was planned to evaluate the effects of xylazine and dexmedetomidine as a preanaesthetic agent with tiletamine-zolazepam anaesthesia on clinico-haemato-biochemical profile in dogs undergoing major surgical procedures.

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Materials and Methods

The present clinical study was conducted in 2025 at the Department of Veterinary Surgery and Radiology, College of

Veterinary Science & A.H., Kamdhenu University, Junagadh, Gujarat (India). A total of 12 dogs undergoing major surgical procedures were enrolled in the study and randomly divided into two equal groups (n=6 each) regardless of age, sex, breed or body weight. Dogs were fasted for 12 h prior to anaesthesia. Dogs in Group I (n=6) received xylazine (1 mg/kg BW, IM), while those in Group II (n=6) received dexmedetomidine (0.01 mg/kg BW, IM). After 15 min of preanaesthetic medication, induction of anaesthesia was done in both groups using tiletamine-zolazepam @ 3 mg/kg BW, IVm till effect, *viz*., the average dose used was 2.84 ± 0.26 mg/kg BW in Group I and 3.38 ± 0.68 mg/kg BW in Group II. The clinico-physiological parameters, *viz*., rectal temperature (°F), heart rate (beats/min), respiratory rate (breaths/min), saturation of oxygen (SpO_2), pulse rate (beats/min), capillary refill time (sec), mucous membrane colour and blood pressure were recorded before administration of preanaesthetic, after induction of anaesthesia and thereafter at every 15-min interval till completion of surgery. Blood samples were collected before premedication, 5 min after induction and at 15th, 30th, 45th and 60th min during anaesthesia. Haematological parameters (Hb, PCV, TEC, TLC, Platelet count and DLC) and plasma biochemical parameters (total protein, ALT, AST, BUN and Creatinine) were estimated using automated instruments and standard diagnostic kits.

Statistical Analysis

Data were expressed as mean ± SE. Statistical analysis was performed using the *t*-test for parametric data and Mann-Whitney test for non-parametric data. Within-group comparisons involving more than two datasets were analyzed using one-way ANOVA followed by Duncan's multiple range test. All analyses were conducted using SPSS software as per Snedecor and Cochran (1994).

Results and Discussion

Clinico-Physiological Parameters

The results of clinico-physiological parameters assessed in the present study are summarized in Table 1.

Rectal Temperature

Rectal temperature gradually decreased over 60 min in both groups, from 102.35 ± 0.27 to 99.86 ± 0.51°F in Group I and from 101.55 ± 0.62 to 99.53 ± 0.72°F in Group II, without significant differences. The slightly greater decline in Group I may be attributed to the hypothermic effect of xylazine resulting from reduced muscle activity and peripheral vasodilation, as reported by Mwangi *et al*. (2014) and Koli *et al*. (2021).

Heart Rate, Pulse Rate, Respiration Rate and SpO_2

Heart rate showed a mild post-induction decline, more pronounced in Group II, reflecting the bradycardic effect of dexmedetomidine, Pulse rate showed a transient increase during the early post-induction period (5-15 min) in both groups, which may be attributed to the initial sympathomimetic effect of tiletamine. This response was slightly more evident in Group I, likely due to the comparatively lower α-selectivity of xylazine, which suggests an initial sympathetic activation before the central sympatholytic effects became predominant, as per McIver *et al*. (2023). Respiration rate decreased significantly from baseline in both groups, with a greater reduction in Group I, indicating stronger respiratory depression with xylazine premedication. SpO_2 values remained within physiological limits, a greater decline was observed in Group I at 60 min, likely reflecting the enhanced respiratory depressant effect of xylazine (Lu *et al*., 2014) and Koli *et al*. (2021).

Capillary Refill Time and Mucous Membrane Colour

The mean values of capillary refill time had a significant increase within group I. While, group II showed no significant variations. Mucous membrane colour remained mostly pink in both groups, with a mild shift toward pale-pink as anaesthesia progressed (Zalavadiya *et al*., 2024; Chandramohan *et al*., 2026).

Systolic, Diastolic and Mean Arterial Pressure

The dogs premedicated with xylazine exhibited a transient post-induction decline in systolic, diastolic and mean arterial blood pressures, although the changes were mild and remained within physiological limits. A comparable haemodynamic response was reported by Kwon *et al*. (2003), who observed a delayed but significant decrease in systolic, diastolic and mean arterial pressure following tiletamine-zolazepam administration in xylazine-premedicated dogs. In contrast, dexmedetomidine-premedicated dogs maintained more consistent systolic, diastolic and mean arterial pressures throughout the observation period, indicating better haemodynamic stability. This may be attributed to the higher α-adrenoceptor selectivity and sympatholytic effects of dexmedetomidine, as previously reported by Zhang *et al*. (2021) and Kusolphat *et al*. (2022).

Haematological Parameters

The haematological parameters of blood samples collected from dogs before, during and at different time intervals post-induction are presented in Table 2. During anaesthesia, haemoglobin, packed cell volume and total erythrocyte count exhibited mild, non-significant declines in both groups. In Group I, haemoglobin decreased from 12.21 ± 0.75 to 9.79 ± 1.01 g/dL, while in Group II it declined from 12.23 ± 0.75 to 10.11 ± 0.45 g/dL, with packed cell volume and total erythrocyte count showing similar trends. The relatively higher erythrocyte indices observed in Group II may be attributed to the greater α-selectivity of dexmedetomidine, resulting in reduced splenic relaxation and better preservation of circulating red blood cells, as

Table 1: Mean ± SE values of clinico-physiological parameters in two groups of dogs at different time intervals of surgical anaesthesia

Parameter	Time interval	Group I	Group II	p-value
Rectal temperature (°F)	0 min	102.35 ± 0.27^{a}	101.55 ± 0.62	0.272
	5 min	101.98 ± 0.29^{ab}	100.58 ± 0.58	0.061
	15 min	101.51 ± 0.28^{abc}	100.63 ± 0.49	0.133
	30 min	100.88 ± 0.54^{bcd}	100.01 ± 0.61	0.321
	45 min	100.43 ± 0.49^{cd}	99.83 ± 0.64	0.485
	60 min	99.86 ± 0.51^{d}	99.53 ± 0.72	0.715
	p-value	**0.002**	0.254	
Heart rate (beats/min)	0 min	113.66 ± 7.80	110.66 ± 6.74	0.785
	5 min	130.50 ± 8.83	113.66 ± 11.23	0.272
	15 min	111.66 ± 5.91	98.00 ± 7.83	0.191
	30 min	107.16 ± 6.22	92.83 ± 6.48	0.147
	45 min	101.66 ± 7.06	98.00 ± 8.35	0.745
	60 min	102.16 ± 3.88	94.00 ± 4.16	0.182
	p-value	0.570	0.297	
Respiration rate (breaths/min)	0 min	39.00 ± 3.37^{a}	40.00 ± 4.19^{a}	0.863
	5 min	23.33 ± 3.05^{b}	22.83 ± 2.76^{b}	0.911
	15 min	21.00 ± 0.85^{b}	22.66 ± 1.60^{b}	0.384
	30 min	18.66 ± 1.54^{b}	23.33 ± 1.97^{b}	0.094
	45 min	19.33 ± 2.56^{b}	24.00 ± 2.68^{b}	0.243
	60 min	20.00 ± 2.00^{b}	23.66 ± 2.15^{b}	0.241
	p-value	**0.001**	**0.001**	
SpO_2 (%)	0 min	88.16 ± 3.74	93.00 ± 1.31	0.251
	5 min	90.66 ± 3.47	89.16 ± 1.97	0.715
	15 min	90.33 ± 2.09	94.66 ± 1.97	0.163
	30 min	92.66 ± 1.56	89.33 ± 2.88	0.333
	45 min	88.50 ± 2.26	94.00 ± 1.69	0.525
	60 min	85.00 ± 4.22^{A}	95.00 ± 1.03^{B}	**0.044**
	p-value	0.640	0.123	
Pulse rate (beats/min)	0 min	94.66 ± 6.84	87.16 ± 4.57	0.879
	5 min	130.16 ± 14.98	109.83 ± 8.70	0.268
	15 min	139.66 ± 13.56	108.66 ± 6.60	0.067
	30 min	130.33 ± 10.49	104.66 ± 7.46	0.074
	45 min	116.83 ± 10.51	102.66 ± 4.28	0.241
	60 min	123.00 ± 13.04	101.00 ± 5.75	0.154
	p-value	0.157	0.186	
Capillary refill Time (sec)	0 min	0.96 ± 0.08^{a}	1.09 ± 0.06	0.289
	5 min	1.29 ± 0.09^{b}	1.29 ± 0.08	1.000
	15 min	1.31 ± 0.06^{b}	1.23 ± 0.10	0.544
	30 min	1.31 ± 0.08^{b}	1.26 ± 0.11	0.709
	45 min	1.21 ± 0.04^{b}	1.26 ± 0.11	0.707
	60 min	1.24 ± 0.02^{b}	1.22 ± 0.07	0.875
	p-value	**0.014**	0.733	
Systolic pressure (mmHg)	0 min	136.50 ± 6.93	150.66 ± 9.40	0.253
	5 min	121.16 ± 25.02	127.16 ± 25.02	0.869
	15 min	93.83 ± 16.27	134.66 ± 14.64	0.092
	30 min	115.50 ± 10.59	139.66 ± 9.15	0.115
	45 min	139.33 ± 10.89	121.33 ± 11.28	0.278
	60 min	134.33 ± 16.45	148.16 ± 13.99	0.536
	p-value	0.316	0.701	
Diastolic pressure (mmHg)	0 min	89.33 ± 5.53	99.83 ± 7.51	0.287
	5 min	86.83 ± 17.96	79.00 ± 15.50	0.748
	15 min	69.50 ± 14.60	90.16 ± 11.49	0.292
	30 min	79.66 ± 6.18	92.50 ± 10.28	0.310
	45 min	96.50 ± 6.67	79.83 ± 9.73	0.188
	60 min	91.16 ± 14.79	110.83 ± 12.63	0.336
	p-value	0.674	0.371	
Mean arterial pressure (mmHg)	0 min	101.16 ± 5.28	122.00 ± 10.73	0.112
	5 min	95.00 ± 20.10	95.50 ± 19.61	0.986
	15 min	75.83 ± 15.49	104.50 ± 13.51	0.193
	30 min	89.16 ± 9.15	107.83 ± 7.79	0.152
	45 min	109.66 ± 8.31	90.66 ± 9.31	0.159
	60 min	100.33 ± 15.42	120.16 ± 13.47	0.356
	p-value	0.578	0.461	

Group-I: Xylazine-tiletamine-zolazepam, Group-II: Dexmedetomidine-tiletamine-zolazepam. Means bearing different superscript, within group (small letter) and between group (capital letter) differ significantly ($p<0.05$).

Table 2: Mean ± SE values of haematological parameters at various time intervals in two groups of dogs during surgical anaesthesia

Parameter	Time interval	Group I	Group II	p-value
Haemoglobin (g/dL))	0 min	12.21 ± 0.75	12.23 ± 0.75	0.988
	5 min	11.48 ± 0.94	11.51 ± 0.61	0.977
	15 min	10.51 ± 1.00	11.26 ± 0.62	0.539
	30 min	10.27 ± 1.03	10.96 ± 0.56	0.569
	45 min	10.10 ± 1.08	10.41 ± 0.49	0.796
	60 min	9.79 ± 1.01	10.11 ± 0.45	0.777
	p-value	0.171	0.493	
Packed cell volume (%)	0 min	31.00 ± 3.23	38.65 ± 3.23	0.125
	5 min	30.03 ± 3.08	36.73 ± 3.28	0.168
	15 min	27.95 ± 2.89	34.90 ± 3.01	0.127
	30 min	27.01 ± 2.93	33.00 ± 3.10	0.191
	45 min	26.13 ± 2.91	31.05 ± 2.69	0.244
	60 min	25.71 ± 2.90	30.28 ± 2.77	0.282
	p-value	0.768	0.349	
Total erythrocyte count (million/ cmm)	0 min	5.43 ± 0.48	6.72 ± 0.51	0.10
	5 min	5.11 ± 0.50	6.42 ± 0.51	0.10
	15 min	4.84 ± 0.50	6.09 ± 0.48	0.10
	30 min	4.67 ± 0.52	5.89 ± 0.50	0.12
	45 min	4.62 ± 0.53	5.77 ± 0.48	0.14
	60 min	4.53 ± 0.54	5.63 ± 0.52	0.18
	p-value	0.816	0.646	
Total leucocyte count (thousand/ cmm)	0 min	23.51 ± 6.37	16.48 ± 4.89	0.469
	5 min	20.46 ± 6.94	13.21 ± 3.26	0.367
	15 min	20.27 ± 6.72	15.02 ± 4.19	0.522
	30 min	18.76 ± 6.59	12.90 ± 3.47	0.455
	45 min	16.06 ± 4.60	14.25 ± 4.15	0.776
	60 min	15.66 ± 4.54	14.32 ± 3.65	0.822
	p-value	0.976	0.990	
Neutrophils (%)	0 min	71.90 ± 2.80	65.50 ± 2.25	0.105
	5 min	72.17 ± 2.49	66.18 ± 2.66	0.132
	15 min	72.25 ± 2.40	58.40 ± 10.71	0.247
	30 min	70.37 ± 3.50	67.98 ± 1.91	0.563
	45 min	72.10 ± 2.74	67.55 ± 2.01	0.211
	60 min	70.46 ± 2.89	68.22 ± 2.05	0.305
	p-value	0.997	0.943	
Lymphocytes (%)	0 min	21.22 ± 2.91	26.57 ± 2.21	0.174
	5 min	21.08 ± 2.66	26.40 ± 2.55	0.180
	15 min	21.07 ± 2.45	25.00 ± 2.58	0.295
	30 min	22.32 ± 3.04	24.93 ± 1.86	0.480
	45 min	21.17 ± 2.55	25.75 ± 2.00	0.188
	60 min	21.52 ± 2.83	25.32 ± 1.99	0.297
	p-value	0.999	0.991	
Monocytes (%)	0 min	5.37 ± 0.69	5.87 ± 0.36	0.536
	5 min	5.50 ± 0.79	5.55 ± 0.39	0.956
	15 min	5.50 ± 0.84	5.32 ± 0.32	0.842
	30 min	6.10 ± 1.54	5.25 ± 0.37	0.604
	45 min	5.78 ± 1.28	5.12 ± 0.26	0.621
	60 min	5.52 ± 0.99	4.80 ± 0.99	0.507
	p-value	0.997	0.348	
Eosinophils (%)	0 min	1.52 ± 0.23	2.07 ± 0.23	0.120
	5 min	1.25 ± 0.22	1.87 ± 0.27	0.108
	15 min	1.18 ± 0.20	1.78 ± 0.27	0.100
	30 min	1.22 ± 0.23	1.83 ± 0.28	0.124
	45 min	0.95 ± 0.16	1.58 ± 0.28	0.076
	60 min	1.00 ± 0.16	1.67 ± 0.26	0.054
	p-value	0.440	0.841	

Group-I: Xylazine-tiletamine-zolazepam, Group-II: Dexmedetomidine-tiletamine-zolazepam. None of the parameters differ significantly between groups or between periods ($p > 0.05$).

suggested by Saini *et al*. (2019). These findings partially agreed with Sutil *et al*. (2017), who reported significant reductions in haemoglobin, packed cell volume and erythrocyte count following α-agonist administration. In contrast, the present clinical study recorded only transient and non-significant changes, possibly due to shorter anaesthetic duration and absence of reversal agents. Similarly, Sharma *et al*. (2014) observed significant reductions in haemoglobin and packed cell volume predominantly in xylazine-based protocols, which were attributed to surgical blood loss and microcirculatory vasodilation rather than a direct drug effect factors that were minimal in the current study. Total and differential leukocyte counts showed only minor, non-significant fluctuations, with transient neutrophilia likely reflecting stress-related catecholamine release and slightly higher lymphocyte proportions in Group II indicating the sympatholytic and cortisol-suppressing effects of dexmedetomidine (Tiwari *et al*., 2024; Chandramohan *et al*., 2026). Overall, the haematological changes observed were clinically non-significant, confirming the haematological safety of both anaesthetic protocols.

Biochemical Parameters

The plasma biochemical parameters, including total protein, creatinine and urea nitrogen, showed mild, non-significant variations (Table 3), with gradual increase at specific intervals possibly due to transient haemodynamic changes (Mujiburraheman, 2021; Zalavadiya *et al*., 2024). The plasma levels of hepatic enzymes (ALT, AST) fluctuated slightly but remained within normal limits, reflecting stable hepatic function and good tolerance to both anaesthetic protocols (Tiwari *et al*., 2024; Chandramohan *et al*., 2026). These findings indicate that both anaesthetic combinations maintained haemato-biochemical stability throughout the procedure.

Table 3: Mean ± SE values of plasma biochemical parameters at various time intervals in two groups of dogs during surgical anaesthesia

Parameter	Time interval	Group I	Group II	p-value
Total protein (g/dL)	0 min	5.20 ± 0.35	5.46 ± 0.36	0.615
	5 min	5.19 ± 0.32	5.06 ± 0.37	0.786
	15 min	4.31 ± 0.75	4.78 ± 0.39	0.589
	30 min	5.31 ± 0.40	4.43 ± 0.87	0.376
	45 min	5.45 ± 0.51	4.81 ± 0.31	0.310
	60 min	5.10 ± 0.57	4.80 ± 0.37	0.670
	p-value	0.675	0.768	
Creatinine (mg/dL)	0 min	0.86 ± 0.09	1.14 ± 0.21	0.250
	5 min	0.98 ± 0.14	1.05 ± 0.16	0.751
	15 min	0.97 ± 0.20	0.90 ± 0.17	0.812
	30 min	1.03 ± 0.14	1.03 ± 0.15	0.987
	45 min	0.97 ± 0.17	0.97 ± 0.09	0.986
	60 min	1.18 ± 0.20	0.99 ± 0.11	0.420
	p-value	0.826	0.928	
Blood urea nitrogen (mg/dL)	0 min	22.48 ± 4.04	24.34 ± 2.38	0.700
	5 min	20.61 ± 2.88	35.90 ± 10.57	0.193
	15 min	23.39 ± 3.54	33.78 ± 10.47	0.369
	30 min	23.47 ± 2.23	34.06 ± 9.93	0.322
	45 min	25.48 ± 2.96	28.02 ± 1.82	0.482
	60 min	36.36 ± 10.31	27.79 ± 1.41	0.430
	p-value	0.325	0.861	
Alanine aminotransferase (IU/L)	0 min	49.18 ± 22.97	18.60 ± 4.71	0.221
	5 min	27.02 ± 7.41	47.21 ± 21.63	0.398
	15 min	47.59 ± 16.43	14.70 ± 2.11	0.075
	30 min	30.28 ± 7.72	14.36 ± 2.61	0.079
	45 min	50.53 ± 21.38	25.83 ± 11.27	0.331
	60 min	40.58 ± 19.06	27.39 ± 5.60	0.522
	p-value	0.875	0.259	
Aspartate aminotransferase (IU/L)	0 min	37.65 ± 17.68	16.70 ± 3.69	0.273
	5 min	23.49 ± 8.85	35.33 ± 12.09	0.448
	15 min	36.64 ± 10.26	21.48 ± 3.61	0.194
	30 min	21.86 ± 1.65	20.37 ± 3.57	0.711
	45 min	38.00 ± 14.38	26.08 ± 7.41	0.478
	60 min	36.20 ± 13.07	24.23 ± 2.03	0.387
	p-value	0.855	0.430	

Group-I: Xylazine-tiletamine-zolazepam, Group-II: Dexmedetomidine-tiletamine-zolazepam. None of the parameters differ significantly between groups or between periods ($p > 0.05$).

Conclusions

The anaesthetic protocols employing xylazine or dexmedetomidine as preanaesthetic agents with tiletamine-zolazepam produced clinically safe and physiologically acceptable anaesthesia in dogs. Clinico-physiological parameters remained within normal limits throughout the observation period. Haematological and biochemical variables showed only mild, non-significant fluctuations, indicating good systemic tolerance. Overall, both anaesthetic combinations performed well and were suitable for use in canine anaesthesia.

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