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Clinico-physiological studies of atropine-tiletamine-zolazepam-sevoflurane anaesthesia with or without dexmedetomidine premedication in dogs

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ABSTRACT

The present study was conducted on twelve dogs randomly divided into two groups, viz. group A and B irrespective of age, breed and sex. Animals of group A were premedicated with atropine sulphate at the dose rate of 0.04 mg/kg body weight subcutaneously while in group B, atropine sulphate at the dose rate of 0.04 mg/kg body weight subcutaneously and dexmedetomidine at the dose rate of 5µg/kg body weight intravenously were administered at 5 min interval. Tiletamine-zolazepam was administered intravenously as induction agent and maintenance with sevoflurane in both the groups of animals. Clinico-physiological, haemodynamic and biochemical parameters were evaluated at various time intervals. Induction time was significantly lower whereas duration of anaesthesia, recovery time and complete recovery time were significantly higher in animals of group B as compared to group A. Excellent muscle relaxation and good analgesia was observed in the animals of group B. Abolition of pedal reflex and palpebral reflex was better in the animals of group B as compared to group A. Physiological parameters fluctuated within the normal limits. Significant decrease in PR interval and significant increase in QRS interval was recorded in the animals of group A. Non-significant changes were observed in the biochemical parameters except significant increase in the serum glucose level was observed at 30 min to 1 h in both the groups of animals. Thus, it was concluded that the anaesthetic combination of atropine-dexmedetomidine-tiletamine-zolazepam-sevoflurane produces better sedation, muscle relaxation and analgesia as compared to atropine-tiletamine-zolazepam-sevoflurane anaesthesia.

Keywords: Basal anaesthesia, Canine, Dexmedetomidine, Tiletamine-zolazepam

Balanced anaesthesia is induced by administration of multiple drugs that produces unconsciousness, analgesia, muscle relaxation and alteration of autonomic reflexes. Therefore, suitable combinations of drugs are needed to produce a state of balanced anaesthesia. Atropine sulphate is an anticholinergic agent, prevents bradycardia and decrease airway and salivary secretions (Lerche 2015). Dexmedetomidine**,** an imidazole compound and alpha-2 adrenergic agonist having very high selectivity for α-2 receptors, produces rapid onset of sedation, analgesia, bradycardia and transient hypertension in early stage (Degroot *et al*. 2020). Tiletamine is an arylcyclohexylamine which is structurally related to ketamine, is a non-competitive NMDA receptor antagonist induces dissociative anaesthesia (Saha *et al.* 2007). Alone it produces cataleptic state and convulsion, hence is used in combination with zolazepam, a benzodiazepine tranquilizer (Ferrari *et al*. 2005). Tiletamine-zolazepam produces smooth muscle relaxation, minimal analgesic effect, smooth induction and lengthy recovery period and retention of pharyngeal and palpebral reflexes (Lin 1996). Sevoflurane, an ether inhalation general anaesthetic produces dose-dependent depression in the cardiovascular, respiratory and central nervous system with minimal changes in haematobiochemical parameters in small animals (Pawson and Forsyth 2008, Jadon *et al.* 2008). The present study was planned to evaluate the clinico-physiological, haemodynamic and biochemical effects of two anaesthetic protocols in canine patients.

MATERIALS AND METHODS

The study was carried out in 12 clinically healthy, adult dogs of both the sexes aged 1.5 to 7.0 years and weighing 15 to 40 kg presented for minor and major surgical procedures at Dr. I.P. Singh Veterinary Clinical Complex and Trauma Centre. All the dogs were kept off feed for 12 h and water was withheld for 6 h prior to the anaesthesia.

Anaesthesia: The dogs were randomly divided into two groups having six animals in each group. Animals of group A were premedicated with atropine sulphate (0.04 mg/kg b.wt. s.c.), while atropine sulphate (0.04 mg/

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kg b.wt. s.c.) and dexmedetomidine (5 µg/kg b.wt. i.v.) were premedicated in group B at 5 min interval. Ten min later, anaesthesia was induced with tiletamine-zolazepam intravenously till effect in both the groups, followed by endotracheal intubation. Anaesthesia was maintained with sevoflurane at an inspired concentration of 2.2%.

Clinico-physiological and haemodynamic parameters: Changes in various clinico-physiological parameters, i.e. induction time, duration of anaesthesia, muscle relaxation, palpebral reflex, pedal reflex, analgesia, recovery time, sternal recumbency time, standing time, complete recovery time, required dose of induction agents (Table 1) were observed in both the groups. Muscle relaxation was judged on the musculature of abdomen, legs and jaws at various time intervals, involved judging the ease with which the jaws could be opened, the limbs could be flexed without much resistance and the flaccidity of abdominal muscles. It was recorded on a score scale of 1 to 4 (Bisht *et al*. 2016). Palpebral reflexes were recorded as a measure of depth of sedation by observing the blink of eyelids on touching the medial canthus with index finger and graded on 0 to 3 score scale at various time intervals. Pedal reflexes were recorded by observing the flexion or withdrawal of the limb in response to vigorous squeezing and pinching of digits or pads and graded on 0 to 3 score scale at various time intervals (Kumar *et al*. 2014). Analgesia was recorded by observing the response to pin pricks on body and digits or pad and graded on 0 to 3 score scale at various time intervals (Kinjavdekar *et al.* 2007). All the reflexes were recorded at 0 min (baseline), 5 min after administration of preanesthetic, at 5, 10, 15, 20, 30, 45, 60, 75 and 90 min intervals after induction with tiletamine-zolazepam. The total dose of tiletamine-zolazepam (mg/kg b.wt.) were calculated in each group. Heart rate, respiration rate, rectal temperature, systolic arterial pressure, diastolic arterial pressure and mean arterial pressure were recorded by veterinary patient monitor (model no. MMED 8000-CV, Beijing Choice Electronic Technology Co. Ltd., Beijing, China) at 0 min (baseline), 5 min after administration of preanesthetic at 5, 15, 30, 45, 60, 75, 90 and 180 min intervals after induction with tiletamine-zolazepam.

Electrocardiography: Electrocardiography was recorded by veterinary ECG machine (model Cardivet, Mediglo systems Chandigarh, India) using the Lead II at 0 min (baseline), 5 min after preanaesthetic, 5 min post-induction and 5 min after maintenance.

Biochemical parameters: Biochemical parameters were estimated by semi-automatic biochemical analyzer at 0 min (baseline), 30 min, 1 h, 6 h and 24 h.

Statistical analysis: The mean and standard error of clinical, physiological, haemodynamic and biochemical parameters recorded at different time intervals were calculated and analysed between the group and within the group by student "t" test and one-way ANOVA using statistical package SPSS software. Kruskal Wallis one-way test was used to compare the medians of non-parametric data within the group at corresponding time intervals.

Table 1. Scoring criteria for palpebral reflex, pedal reflex, muscle relaxation and analgesia

Criteria	Score	Observation
Palpebral reflex	0	Intact and strong (quick blink)
	1	Intact but weak (slow response)
	2	Very weak (very slow and occasional)
	3	Abolished
Pedal reflex	0	Intact and strong (strong withdrawal)
	1	Intact but weak (animal responding slowly)
	2	Intact but very light (slow and occasional response)
	3	Abolished completely
Muscle relaxation	1	Tightly closed jaws, stiff limbs resisting all attempts to flex and tight abdominal muscles (no muscle relaxation)
	2	Moderate resistance to opening of the jaws and flexing of the limbs, mild flaccidity of the abdominal muscles (mild relaxation)
	3	Mild resistance to opening of the jaws and flexing of the limbs, moderate flaccidity of the abdominal muscles (moderate relaxation)
	4	No resistance to opening of the jaws and flexing of the limbs, completely flaccid abdominal muscles (excellent relaxation)
Analgesia	0	Strong reaction to pin pricks (no analgesia)
	1	Weak response to pin pricks (mild analgesia)
	2	Occasional response to pin pricks (moderate analgesia)
	3	No response to pin pricks (excellent analgesia)

$P<0.05$ was set as a level of significance.

RESULTS AND DISCUSSION

Anaesthetic parameters: The induction time was 81.00±4.34 s and 39.50±2.69 s in animals of group A and B. Induction time was significantly ($P<0.01$) lower in animals of group B premedicated with atropine sulphate and dexmedetomidine as compared to group A premedicated with atropine sulphate. Administration of alpha-2 agonist before induction with tiletamine-zolazepam reduces the induction time in the dogs which might be due to sedative and analgesic effect of alpha-2 agonist drugs (Hafez *et al.* 2017; Karasu *et al.* 2018, Ratnu *et al.* 2021, Koli *et al.* 2021). The duration of anaesthesia, recovery time and sternal recumbency time were 66.50±3.45 min, 6.17±0.31 min and 11.00±0.68 min in group A, whereas 90.83±3.78 min, 8.83±0.40 min and 15.50±0.92 min. respectively in group B. Duration of anaesthesia, recovery time and sternal recumbency time were significantly ($P<0.05$) higher in group B as compared to group A. The increase in the duration of anaesthesia, recovery time and sternal recumbency time may be due to the sedative effect of dexmedetomidine (Chang and Jang 1998; Kwon *et al.* 2003, Kumar *et al.* 2016, Saini *et al.* 2017, Bisht *et al.* 2018b) and tiletamine. Although, standing time was

16.67±1.38 min in group A whereas 20.83±1.32 min in group B. Standing time was non-significantly (P>0.05) higher in animals of group B as compared to group A. The complete recovery time was 29.50±1.84 min and 38.67±1.72 min in animals of groups A and B, respectively. Complete recovery time was significantly (P<0.05) higher in group B as compared to group A. Tiletamine inhibits pain by blocking the NMDA receptors non-competitively and prolongs the duration of anaesthesia and recovery period in the animals, which might be due to longer plasma half-life of the drug. Premedication improves the recovery quality in the animals induced with tiletamine-zolazepam (Pablo and Bailey 1999, Kwon *et al.* 2003). Dexmedetomidine have very high selectivity for α-2 receptors and augments depression of central nervous system, thereby produces their sedative and analgesic property and improves the recovery quality in the animals (Riviere and Papich 2018). The induction dose of tiletamine-zolazepam in group B (1.86±0.11 mg/kg b.wt.) was significantly (P<0.01) lower than group A (6.60±0.06 mg/kg b.wt.). This decrease in the induction dose of non-barbiturate may be due to sedation potentiating effect of dexmedetomidine. Similar observation in the reduction of barbiturate dose have been reported by Jadon *et al.* (1998), Saini *et al.* (2019), Tiwari *et al.* (2021).

Clinico-physiological parameters: The median±SE values of various anaesthetic reflexes are listed in Supplementary Table 1. Adequate muscle relaxation and analgesia was observed in animals of both the groups. However, in animals of group A, excellent muscle relaxation and analgesia was observed at 5 min after induction of anaesthesia up to the end of anaesthetic period whereas in group B, muscle relaxation and analgesia was moderate at 5 min after premedication followed by excellent muscle relaxation and analgesia at 5 min post-induction, which persisted up to the end of anaesthetic period. After discontinuation of anaesthesia, normal muscle tone was attained. Moderate muscle relaxation in group B after premedication might be due to alpha-2 agonist property of dexmedetomidine, which is attributed to inhibition of intraneuronal transmission of impulses at the level of central nervous system (Lemke 2007) whereas excellent muscle relaxation was recorded at post-induction which might be due to adequate muscle relaxing property of zolazepam (Hampton *et al.* 2019, Ratnu *et al.* 2021). The muscle relaxation might also be enhanced due to co-administration of tiletamine-zolazepam and sevoflurane as anaesthetics with dexmedetomidine. Prolong duration and quality of analgesia was observed in the present study which might be due to the effect of dexmedetomidine, tiletamine and sevoflurane. Similar finding was also reported by Hafez *et al.* 2017, Hampton *et al.* 2019, Koli *et al.* 2021 and Ratnu *et al.* 2021. In animals of group A, palpebral reflex was completely abolished from 15 min post-induction up to the end of anaesthetic period whereas in group B, the reflex was intact but very weak at 5 min after premedication to 10 min post-induction, followed by complete abolition of reflexes up to the end of anaesthetic period. In animals of group A, pedal reflex was completely abolished from 10 min post-induction up to the end of anaesthetic period whereas in group B, the reflexes were intact but very weak at 5 min after premedication, followed by complete abolition of reflexes up to the end of anaesthetic period. Presence of pedal and palpebral reflex were recorded after induction with tiletamine-zolazepam which got abolished after maintenance with inhalant anaesthesia. Similar finding was also reported by Hampton *et al.* (2019) in dogs. Greater suppression of reflexes was recorded in dogs administered balanced anaesthesia, which might be due to synergistic effect of drugs administered along with dexmedetomidine (Ahmad *et al.* 2013).

The mean±SE values of various physiological parameters recorded in this study and are given in Table 2. Mean heart rate was significantly (P<0.05) increased in the animals of group A at 5 min to 30 min post-induction, then it decreased gradually up to 180 min post-induction as compared to baseline values. In group B, non-significant (P>0.05) decrease was observed at 5 min after administration of preanaesthetic, followed by non-significant increase at 5 min to 30 min post-induction as compared to the baseline values. Thereafter, heart rate was gradually decreased up to end of anaesthetic period. Initial increase in the heart rate of animals of group A might be due to vagolytic effect of atropine sulphate and tiletamine-zolazepam whereas premedication with dexmedetomidine reduced the heart rate in the animals of group B which might be due to vagal activation by α-2 adrenoceptors, potential pre-functional α-2 inhibition at cardiac pacemaker tissues and involvement of baroreceptor reflex under α-2 adrenoceptor agonist (Sarzan *et al.* 1989, Tarraga *et al.* 2000, Bisht *et al.* 2018a, Pereira *et al.* 2019). Mean respiration rate was significantly (P<0.05) decreased in the animals of group A at 5 min to 30 min post-induction as compared to the baseline values. Significant decrease was observed in group B at 5 min after administration of preanaesthetic to 30 min post-induction as compared to the baseline values. There was gradual increase in the mean respiration rate from 45 min post-induction up to the end of anaesthetic period in both the groups A and B and the values reached near to the baseline at 3 h. Respiratory depressant effect of α-2 agonist is likely to be exaggerated when used in combination with other anaesthetic agents (Jadon *et al*. 1998, Kwon *et al.* 2003, Pereira *et al.* 2019, Ratnu *et al.* 2021). Mean rectal temperature was non-significantly (P>0.05) decreased in the animals of group A at 5 min after administration of preanaesthetic to 30 min post-induction, then it decreased non-significantly (P>0.05) at 60 min to 75 min post-induction as compared to baseline values. Significant decrease was observed in animals of group B at 5 min to 60 min post-induction as compared to the baseline values. It increased gradually at 75 min up to end of anaesthetic period as compared to the baseline values. The decrease in rectal temperature might be attributed to reduced heat production due to decreased metabolic rate during

Table 2. Recording of physiological and haemodynamic parameters in animals of both the groups (Mean±SE)

Parameter	Group	Time interval									
		0 min	5 min after preanaesthetic	5 min post-induction	15 min	30 min	45 min	60 min	75 min	90 min	180 min
Heart rate (beat/min)	A	88.50±5.39^{b}	102.67±6.98^{ab}	126.00±12.00^{a}	129.00±12.11^{a}	129.67±12.75^{a}	127.67±13.33^{a}	119.50±10.64^{ab}	110.50±9.66^{ab}	100.67±7.20^{ab}	92.00±5.12^{b}
	B	89.33±5.59^{ab}	76.67±4.86 ^{b}	94.50±6.04^{ab}	101.67± 6.20^{a}	105.00±6.21^{a}	104.83±6.60^{a}	104.50±7.61^{a}	100.83±7.55^{a}	97.17±6.99^{a}	92.17±5.87^{ab}
Respiration rate (breath/min)	A	30.00±0.51^{a}	29.50±0.61^{a}	19.17±0.60^{cd}	17.33±0.84^{d}	16.33±1.02^{d}	17.00±0.73^{d}	18.33±0.61^{d}	18.67±0.76^{d}	22.17±0.75^{c}	25.50±0.42^{b}
	B	26.67±1.54^{a}	18.00±0.85^{bc}	11.83±0.94^{d}	11.66±0.71^{d}	11.33±0.21^{d}	13.00±0.96^{d}	14.00±0.68^{cd}	15.33±1.11^{bcd}	18.67±1.40^{b}	23.50±0.72^{a}
Rectal temperature (°C)	A	38.56±0.05^{a}	38.50±0.04^{ab}	38.39±0.08^{ab}	38.28±0.10^{ab}	38.22±0.13^{ab}	38.05±0.17^{b}	38.13±0.13^{ab}	38.10±0.12^{ab}	38.21±0.12^{ab}	38.47±0.06^{ab}
	B	38.57±0.06^{a}	38.39±0.04^{ab}	38.23±0.03^{bc}	38.15±0.03^{cd}	38.11±0.03^{cd}	37.94±0.03^{de}	37.80±0.03^{e}	37.88±0.04^{e}	38.19±0.05^{bc}	38.37±0.06^{ab}
Systolic arterial blood pressure (mm Hg)	A	134.67±3.46^{ab}	145.17±3.36^{a}	129.50±2.21^{bc}	131.00±2.39^{b}	123.67±2.24^{bcd}	117.67±2.97^{cd}	116.50±3.67^{d}	122.00±1.50^{bcd}	127.33±2.01^{bcd}	134.17±2.98^{ab}
	B	131.50±3.87^{f}	150.17±3.53^{bcd}	162.00±4.20^{ab}	167.67±3.82^{a}	164.67±2.75^{ab}	155.50±2.20^{abc}	147.00±1.86^{cde}	140.83±2.08^{def}	135.17±2.64^{ef}	130.33±3.20^{f}
Diastolic arterial blood pressure (mm Hg)	A	83.67±3.46^{ab}	94.17±3.36^{a}	78.50±2.21^{bc}	80.00±2.39^{b}	72.67±2.24^{bcd}	66.67±2.97^{cd}	65.50±3.67^{d}	70.83±1.47^{bcd}	76.17±1.99^{bcd}	83.17±2.91^{ab}
	B	80.50±3.87^{f}	98.33±3.45^{bcd}	110.17±4.12^{ab}	115.83±3.68^{a}	112.83±2.41^{a}	103.67±1.92^{abc}	95.17±1.78^{cde}	89.00±2.16^{def}	83.33±3.01^{ef}	78.33±3.41^{f}
Mean arterial blood pressure (mm Hg)	A	100.17±3.66^{ab}	110.67±3.55^{a}	97.00±1.75^{bc}	96.17±1.97^{bc}	88.83±2.01^{bcd}	82.83±2.91^{d}	81.67±3.54^{d}	86.83±1.53^{cd}	91.83±2.56^{bcd}	97.67±3.48^{abc}
	B	97.00±4.01^{f}	115.67±3.62^{bcde}	127.50±4.30^{abc}	133.17±3.91^{a}	130.17±2.68^{ab}	122.67±2.09^{abcd}	114.17±1.66^{cde}	108.00±1.67^{def}	102.33±2.74^{ef}	97.33±3.46^{f}
Haemoglobin oxygen saturation (SpO_2) (%)	A	96.50±0.43^{a}	96.67±0.21^{a}	85.17±1.01^{d}	90.33±1.33^{c}	92.67±0.95^{bc}	95.00±0.45^{ab}	96.00±0.00^{a}	96.17±0.54^{a}	96.67±0.49^{a}	97.00±0.36^{a}
	B	97.17±0.54^{a}	96.67±0.56^{a}	91.17±0.83^{c}	93.50±0.56^{bc}	95.17±0.47^{ab}	95.67±0.42^{ab}	96.50±0.56^{a}	96.83±0.54^{a}	96.33±0.49^{a}	96.83±0.47^{a}

The pair of values with different superscript vary significantly (P<0.05).

Table 3. Electrocardiographic parameters in animals of both the groups (Mean±SE)

Parameter	Groups	0	5 min after preanaesthetic	5 min post-induction	5 min after maintenance
PR interval (s)	A	0.109±0.006[a]	0.091±0.005[ab]	0.083±0.003[b]	0.071±0.005[b]
	B	0.101±0.009	0.149±0.024	0.122±0.012	0.099±0.011
QRS interval (s)	A	0.045±0.005[b]	0.046±0.005[a]	0.045±0.00[b]	0.047±0.00[a]
	B	0.059±0.004	0.076±0.004	0.066±0.007	0.078±0.014
QT interval (s)	A	0.212±0.014	0.207±0.014	0.193±0.014	0.191±0.015
	B	0.213±0.013	0.255±0.016	0.213±0.007	0.223±0.009

The pair of values with different superscript vary significantly (P<0.05).

anaesthesia or by action of the drug on the hypothalamus or reduction in peripheral circulation or due to muscle relaxation (Ahmad *et al.* 2013). Dexmedetomidine has also been reported to activate α-2 receptors which lead to decrease in rectal temperature (Lemke 2007, Kumar *et al.* 2016, Bisht *et al.* 2018a).

Haemodynamic parameters: The mean±SE values of various haemodynamic parameters recorded in this study and are given in Table 2. Mean systolic arterial pressure, mean diastolic arterial pressure and mean arterial blood pressure were significantly (P<0.05) decreased at 45 min to 60 min post-induction as compared to the baseline values and increased gradually at 75 min post-induction up to the end of anaesthetic period in the animals of group A. In group B, significant increase was observed in the systolic arterial blood pressure, diastolic arterial blood pressure and mean arterial blood pressure at 5 min after administration of preanaesthetic to 15 min post-induction as compared to the baseline values, followed by gradual decrease at 30 min post-induction up to the end of anaesthetic period. Increase in systemic blood pressure initially in both the groups of animals was due to atropine sulphate and stimulation of peripheral α-2 agonist receptors by dexmedetomidine (Vainio and Palmu 1989, Bisht *et al.* 2018a, Bisht *et al.* 2018b, Tiwari *et al*. 2021). This decreased arterial blood pressure after administration of tiletamine-zolazepam was due to decrease in the peripheral vascular resistance (Hellyer *et al.* 1989). Haemoglobin oxygen saturation was significantly (P<0.05) decreased at 5 min post-induction in the animals of both the groups as compared to baseline values. It increased gradually and reached to baseline values at the end of anaesthetic period. Similar finding was also reported by Chen *et al.* (2005) and Savvas *et al.* (2005). Post-induction apnoea and respiratory depression was the major adverse effect occurred shortly after intravenous administration of tiletamine-zolazepam without premedication, which resolved within min. Premedication with dexmedetomidine reduces the induction dose of tiletamine-zolazepam, thus reduces these adverse effects to some extent.

Electrocardiographic parameters: The mean±SE values of various electrocardiographic parameters recorded in this study is given in Table 3. Significant (P<0.05) decrease in PR interval was recorded at 5 min post-induction and 5 min after maintenance in the animals of group A as compared to baseline values. This reduction in PR interval was due to increase in heart rate caused by atropine sulphate and tiletamine which reflects increase in the conductivity of the cardiac stimuli between the sinus node and atrioventricular node. Similar finding was also reported by Tarraga *et al.* (2000) in the dogs anesthetized with atropine-tiletamine-zolazepam. Significant increase in QRS interval was recorded at 5 min after administration of preanaesthetic and maintenance in the animals of group A whereas non-significant changes was recorded in QT interval in the animals of group A as compared to baseline values. Non-significant changes were recorded in PR interval, QRS interval and QT interval in the animals of group B at respective time interval.

Biochemical parameters: The mean±SE values of various biochemical parameters are listed in Supplementary Table 2. Significant (P<0.05) increase in serum glucose was recorded at 30 min to 1 h in both the groups of animals as compared to baseline values, which might be attributed to either insulin suppression from pancreas by the activity of the drug on alpha-2 receptors of the beta cells or due to increased glucose production in the liver by glycogenolysis. Similar findings were also reported by Bougherara and Bouaziz (2014) in the rats anaesthetized with tiletamine-zolazepam. Non-significant decrease in serum total protein and serum albumin was recorded at 30 min to 1 h in both the groups of animals as compared to baseline values. Similar finding was also reported by Kwon *et al.* (2003), Duzgan *et al.* (2004), Koli *et al.* (2021). This decrease in serum total protein and serum albumin might be due to inter-compartmental shifting of fluid causing haemodilution. Similarly, non-significant decrease in serum urea nitrogen, serum creatinine, ALT and AST were recorded at 30 min in animals of both the groups as compared to baseline values, which indicates least adverse effect of these anaesthetic combinations in kidney and liver. All the parameters in both the groups of animals reached near to the baseline values at 24 h period. Similar finding was also reported by Won *et al.* (2010) and Koli *et al.* (2021) in the dogs anaesthetized with tiletamine zolazepam combinations.

In conclusion, both anaesthetic combinations produced satisfactory anaesthesia, muscle relaxation, analgesia, transient changes in clinicophysiological, haemodynamic and biochemical parameters. However, comparing all the above facts, dexmedetomidine @5 µg/kg body weight along with atropine-tiletamine-zolazepam-sevoflurane anaesthesia produces better muscle relaxation, analgesia,

sedation, good anaesthetic depth and smooth recovery without any complications.

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