RESEARCH PAPER

Blood gas and acid–base status during tiletamine/zolazepam anaesthesia in dogs

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Abstract

Objective To evaluate the effect of the tiletamine/zolazepam (TZ) combination (Zoletil 100; Virbac, Carros, France) with and without atropine on blood gas values and acid–base status in dogs.

Study design Randomized cross-over experimental study.

Animals Six healthy adult cross-bred dogs, weighing 11.0–18.5 kg.

Materials and methods Each dog received four different drug treatments at intervals of at least 15 days: (i) 5 mg kg^{-1} intravenous (IV) TZ (TZ.IV); (ii) 10 mg kg^{-1} intramuscular (IM) TZ (TZ.IM); (iii) atropine, 20 μg kg^{-1} IV, followed 5 minutes later by 5 mg kg^{-1} TZ IV (A.TZ.IV); and (IV) atropine (same dose) given 5 minutes before 10 mg kg^{-1} TZ IM (A.TZ.IM). Arterial blood samples were collected from each dog before drug administration (baseline) at induction of anaesthesia (time 0) and 2, 5, 10 and 30 minutes thereafter.

Results Transient hypoxaemia and respiratory acidosis were observed just after induction. PaO_2 and SaO_2 dropped, while H^+ concentration and $PaCO_2$ rose significantly above baseline values. In groups TZ.IV and A.TZ.IV, PaO_2 values as low as 6.0–6.4 kPa (45–48 mm Hg) were recorded. However, there was no significant difference in blood gas variables among the groups encountered during the evaluation period. The overall change in [HCO_3^-] and base excess (BE) was not significant among groups. Atropine did not affect the above variables.

Conclusions and clinical relevance Tiletamine/zolazepam injection may induce transient hypoxaemia and respiratory acidosis, but acid–base status changes are clinically unimportant. Particularly, close observation of dogs is recommended during the first 5–10 minutes after induction with TZ, especially in animals with cardiopulmonary disease. TZ should perhaps not be used in animals intolerant of tachycardia.

Keywords blood gas values, dogs, tiletamine, zolazepam.

Introduction

Zoletil (Zoletil 100; Virbac, Carros, France) is a combination of equal parts (by weight of free base) of tiletamine hydrochloride, a cyclohexamine anaesthetic and zolazepam hydrochloride, a benzodiazepine tranquillizer. The proprietary name for this drug combination in North America is Telazol. The combination has been widely used for preanaesthetic medication, sedation, immobilization

and general anaesthesia for diagnostic and minor procedures in dogs, cats, ruminants, pigs and non-domestic animals (Ilkiw 1992; Lin 1996; Pablo & Bailey 1999). An antimuscarinic drug, e.g. atropine or glycopyrrolate, may be used to control excessive salivation, which is commonly seen in animals receiving this combination (Short 1987; Lin 1996).

Tiletamine/zolazepam (TZ) depresses respiration, especially when high doses are used (Pablo & Bailey 1999). It reduces ventilation (tidal and minute volume) after intravenous (IV) or intramuscular (IM) injection and may induce hypoxaemia and cyanosis in dogs. In previous studies, the administration of Telazol (20 mg kg^{-1} IM) to dogs was reported to have reduced ventilation to about one-third of control values and decreased PaO_2 during the 15 minutes after injection (Short 1987; Pablo & Bailey 1999). However, blood gas values were not reported. In another study involving dogs (Hellyer et al. 1989), Telazol (6.6 mg kg^{-1} IV) decreased minute ventilation 1 minute post-injection, while 19.8 mg kg^{-1} IV decreased minute ventilation for at least 90 minutes. However, the effect of these changes on blood gas values were not reported. In a clinical study, 55 dogs received 2–4 mg kg^{-1} of Telazol IV without pre-anaesthetic medication, and significant variation in breathing patterns was observed (Donaldson et al. 1989). Arterial blood gas analysis, performed in only six of these, indicated the presence of marginal hypoxaemia (PaO_2 10.7–10.9 kPa (81–82 mm Hg)) and normocapnia ($PaCO_2$ 4.9–5.3 kPa (37–40 mm Hg)). Cullen & Reynoldson (1997) reported no significant changes in PaO_2 values, and a significant elevation in $PaCO_2$ 3 minutes after the IM injection of 3 mg kg^{-1} TZ in five dogs. Hypercapnia persisted for at least 10 minutes after injection. In short, there appears to be limited information on arterial blood gas tensions during TZ anaesthesia in dogs.

In addition to a paucity of blood gas data, the TZ doses used in previous studies were often out with the range routinely used when this drug combination is employed as a sole agent for minor procedures or chemical restraint. The aim of the current study was to evaluate the blood gas values and acid–base status of dogs under TZ anaesthesia, using dose rates at the lower limits of the manufacturer's recommendations. The effect of atropine on these variables was also investigated, as atropine causes bronchodilatation and increases anatomic and physiological dead space (Thurmon et al. 1996).

Materials and methods

Six adult mongrel dogs were used in this study: three females and three males, whose body masses ranged from 11.0 to 18.5 kg and whose ages ranged from 2 to 5 years. The dogs were judged to be healthy on the basis of clinical and laboratory (complete blood count, biochemical profile, thoracic radiography and electrocardiography) evaluation. The study was approved by the Centre's Ethical Committee.

Each dog received four different drug treatments: (i) 5 mg kg^{-1} TZ IV (group TZ.IV); (ii) 10 mg kg^{-1} TZ IM (group TZ.IM); (iii) 20 μg kg^{-1} IV atropine followed by 5 mg kg^{-1} TZ IV 5 minutes later (group A.TZ.IV) and (iv) 20 μg kg^{-1} IV atropine followed by 10 mg kg^{-1} TZ IM 5 minutes later (group A.TZ.IM). The treatment sequence was randomized using a table of random numbers. There was an interval of at least 15 days between treatments in each dog. Food was withheld for 6–8 hours and water for 2 hours before anaesthesia. Animals were acclimatized to the operating room and assisting staff before the experiment began, in an attempt to minimize stress and the need for physical restraint.

Before drug injection, an intravenous catheter was introduced into either the left or right cephalic vein and a crystalloid solution (Sodium chloride 0.9% IV solution, Bioser SA, Trikala, Greece) was administered at 5 mL kg^{-1} $hour^{-1}$. A catheter was also introduced into the left dorsal metatarsal artery, flushed with heparinized saline and secured in place. Heart rate was recorded using an ECG monitor (PC Scout, SpaceLabs Medical Inc., Redmond, WA, USA) in all animals during the evaluation period, while vital signs, including the 'depth' of anaesthesia, respiratory rate and pattern, were also monitored. The incidence of salivation was recorded.

An arterial blood sample was collected before any drugs were injected and analysed for baseline data. Five minutes later, TZ was administered IV through the venous catheter or IM into the semimembranosus–semidendinosus muscle group. The animal was observed for signs of painful injection. Immediately after blood sampling (5 minutes before the administration of TZ), atropine (Atropine sulphate, Demo S.A., Athens, Greece) was given IV in groups A.TZ.IV and A.TZ.IM. Induction of anaesthesia was defined as being complete when righting reflexes were lost. Induction time was the period from TZ injection until anaesthesia was induced. The quality of induction to anaesthesia was recorded using subjective criteria. Five arterial blood