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The Use of Propofol as an Anaesthetic Agent in Dogs with Visceral Leishmaniasis

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Abstract: The objective of this study was to determine the suitability and adverse effects of propofol as an anaesthetic agent in atropine-fentanyl-diazepam premedicated dogs with Visceral Leishmaniasis (VL^+) and to compare it with clinically healthy dogs not infected with Visceral Leishmaniasis (VL^-). Ten dogs of mixed breed infected by *L. infantum* (VL^+) and a control group of 10 dogs (VL^-) of mixed breed were used in this study. Dogs were premedicated with atropine sulphate (0.045 mg kg^{-1} subcutaneous) fentanyl (0.02 mg kg^{-1} intravenous) and diazepam (1 mg kg^{-1} intravenous) followed by induction of anaesthesia with 6 mg kg^{-1} of propofol IV. Anaesthesia was maintained with propofol (4-5 mg kg^{-1}) as an intermittent bolus administration. Heart rate respiratory rate and rectal temperature were measured before premedication (baseline) and 5, 10, 15, 20, 25, 30, 45, 60 after induction and 24 h after anaesthesia. Some biochemical and haemalotogical parameters, were measured before premedication (baseline) and 15, 30, 45, 60 min as well as 24 h after anaesthesia. The total amount of propofol in the VL^+ group (18.2±3.8 mg kg^{-1}) was significantly lower compared to 24.6±3.4 mg kg^{-1} in the VL^- group ($p<0.05$). Haemoglobin haematocrit and the number of RBC decreased significantly in both groups at 60 min of anaesthesia ($p<0.05$ for both groups) and had also returned to baseline 24 h after propofol administration. Propofol seems to be suitable agent for inducing and maintaining a short period of anaesthesia in *Leishmania infantum* infected dogs premedicated with atropine fentanyl and diazepam. However, haematocrit and haemoglobin concentration should be monitored closely.

Key words: Propofol, leishmaniasis, anaesthesia, dog

INTRODUCTION

Visceral Leishmaniasis (VL) is an infectious disease transmitted by sandflies of thesubfamily Phlebotominae and caused by various species of *Leishmania* parasites (Juttner *et al*., 2001). It is endemic in the Mediterranean area including Turkey (Ozensoy *et al*., 1998). High infection rates (3.6-25%) were detectedamong the dog populations in human visceralleishmaniasis endemic areas and the isolates from human VL and canine VL cases wereidentified as *Leishmania infantum* by isoenzyme analysis excreted factor serotyping reaction with species-specific monoclonal antibodies and PCR in Turkey (Ozensoy *et al*., 1998). However, there are no reports of problems in anaesthetic management of dogs with VL. Dogs with VL have problems unique to them that may influence the anaesthetic management. Of particular concern to an anesthesiologist are the presence of haematological abnormalities (anaemia, leucopaenia, thrombocytopaenia) and hypoalbuminaemic malnutrition (Ciaramella *et al*., 1997; Dubey *et al*., 2001).

Propofol is a non-barbiturate agent that is used as an induction agent and as a maintenance anaesthetic delivered by continuous IV infusion or intermittent bolus injection. This unique anaesthetic agent is a sedative/ hypnotic with clinical properties (Branson and Gross, 1994). Quick recovery after infusion or multiple dosings is attributed to rapid drugelimination. Respiratory depression is an important complication in human beings cats horses and dogs after IV propofol administration (Cockshot *et al*., 1992; Robertson *et al*., 1992). Other adverse effects attributed to propofol administration in dogs cats and rats include signs of pain on injection and vomiting during recovery (Branson and Gross, 1994). There is a no information about the effects of propofol on intraoperative haemodynamic and respiratory data and various postoperative recovery times under conditions of chronic hypoalbuminaemic dogs. Cavaliere *et al*. (2005) report that hypoalbuminaemia in human does not affect the accuracy of Diprifusor during sedation with propofol. They hypothesized that hypoalbuminaemia may affect the accuracy of Target-Controlled Infusion (TCI) by introducing major deviations in propofol pharmacokinetics. Their results however, failed to show

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significant differences in the accuracy of the Diprifusor between hypo- and normoalbuminaemic patients.

To the author's knowledge use of propofol as an induction agent in dogs infected with VL has not been reported yet. Therefore, the objective of the study reported here was todetermine the suitability and adverse effects of propofol as an anaesthetic agent in atropine-fentanyl-diazepam premedicated dogs with VL and to compare it in clinically normal animals.

MATERIALS AND METHODS

The study was approved by the University of Adnan Menderes Institutional Animal Care and Use Committee. Ten dogs (6 males and 4 females) of mixed breed naturally infected by *L. infantum* (VL^+) aged between 11 and 38 months and ranging in weight from 10-25 kg and 10 healthy dogs (5 males and 5 females) (VL^-) of mixed breed between 12 and 50 months old and weighing 8-32 kg were used. The control animals had normal hepatic function as determined by routine biochemistry. All were graded physical status I. The VL^+ showed a gradual onset of clinical signs and the course of the disease was progressive in all the cases. Dogs in this group were in variable physical condition and were categorized as physical status II to III. The clinical diagnosis was always confirmed serologically by the immunofluorescence test (IFAT).

The dogs were kept in a controlled environment (room temperature 21-24°C; 55-65% humidity). A standard clinical examination preceded general anaesthesia. A catheter (Insyte 18 SWG Beybi Wellcath Istanbul) was aseptically placed into a cephalic or lateral saphenous vein. The dogs required minimal restraint and lidocaine was infiltrated locally to reduce pain and discomfort. The dogs were then allowed to relax permitting cardiopulmonary variables to stabilise before baseline measurements were obtained. Dogs were premedicated with atropine sulphate (0.045 mg kg^{-1} SC Atropin Egevet) fentanyl 0.02 mg kg^{-1} IV Fentanyl) and diazepam (1 mg kg^{-1} IV Diazepamratiopharm). They were positioned in right lateral recumbency and a catheter (Insyte 18 SWG Beybi Wellcath Istanbul) was introduced into the right femoral artery after local anesthesia (Adocain 1% Sanovel) for blood pressure measurement (Petaş Monitor Petaş İstanbul). Ten minutes after premedication each dog received propofol (6 mg kg^{-1} IV Propofol Abbott) for anaesthetic induction injected over 30 sec. Additional propofol was given (0.5-1 mg kg^{-1} IV), if required for orotracheal intubation. After induction of anaesthesia the dogs were positioned on the table in lateral recumbency. Anaesthesia was maintained with intermittent boluses of propofol (4-5 mg kg^{-1} IV). Reflexes palpebral and pedal withdrawal reflexes were assessed to determine the need for additional propofol. Each dog was anaesthetised for 1 h. Immediately post-induction if the dog did not breathe within 30 sec ventilation was assisted using a Bain breathing system until spontaneous breathing.

Heart rate respiratory rate and rectal temperature were measured before premedication (baseline) and 5, 10, 15, 20, 25, 30, 45 and 60 min after induction and the following morning 24 h after drug administration. Mean arterial pressure was measured at 15, 30, 45 and 60 min after induction.

Serum albumin and total proteins alanine aminotransferase (ALT) aspartate aminotransferase (AST) creatinine and urea were measured before premedication (baseline) and 15, 30, 45, 60 min and 24 h after anaesthesia with propofol. Venous blood samples (4-5 mL) was obtained from the lateral saphenous vein and centrifuged at 3000 rpm for 10 min at room temperature to separate serum. The values of serum albumin, total protein, ALT, AST, creatinine and urea were determined by Microlab 2000 (Merck) using commercially available kits (Biomedical Systems Barcelona Spain). The analyses were carried out according to the manufacturer's instructions. To detect the other haematologic parameters such as counting the number of erythrocytes and leukocytes Packed Cell Volume (PCV) and haemoglobin concentration blood was collected in heparinised tubes at baseline 15, 30, 45, 60 min after induction and 24 h after anaesthesia and analysed by a automatic cell counter (9000 3-Part-Diff Freiburg, Germany). Any side effect (vomiting, salivation, diarrhea, apnoea, cyanosis) irritation at the site of injection and other specific observation were recorded as appropriate during the study. Apnoea was defined as complete cessation of spontaneous respiratory effect. In addition, down time (the time from injection to when the dog was unable to stand) sternal recumbency (the time from down time to recumbency (the time from down time to the time when the dogs was able to attain sternal recumbency) and rising time (the time from sternal recumbency to the time when the dog was able to stand again) were also noted.

Statistical analysis: Results were expressed as means±S.D. For haematobiochemical and physiological data a one-way ANOVA for repeated measures was performed to compare values within groups. This was followed by a Waller Duncan post hoc test and was associated with a Levine's test for equals of variances. For differences among groups a Student's t-test was performed. A significance value of $p<0.05$ was used. Differences between groups regarding mean time to movement into sternal recumbency and the total amount of propofol required to induce and maintain anaesthesia were detected with Student's t-test.

RESULTS

Signs of pain were not detected at the time of injection. Apnoea was a frequent adverse effect after propofol administration. A short period of apnoea (20-30 sec) was observed in 4 dogs with VL and in 3 dogs of control group. However, muscle paddling and regurgitation were not observed in any of the dogs during or after induction. Dogs did not respond to stimuli (toe pinch hair plucking) at 5 min after induction. No dog vomited in recovery. Recovery was rapid and uneventful in both groups. Mean time to movement into sternal recumbency was 12±2 min in VL^+ group and 11±3 in VL^- group. The time taken to stand was not delayed with VL^+ group compared with VL^- group. All dogs of both groups were able to walk within 20 min of the end of the anaesthesia with propofol. The total amount of propofol required to induce and maintain anaesthesia for an hour was 24.6±3.4 mg kg^{-1} in VL^- group and this significantly decreased to 18.2±3.8 mg kg^{-1} in VL^+ group ($p<0.05$).

Heart rate respiratory rate and body temperature are shown in Table 1. The lowest heart rates were recorded at 60 min (88±4 and 90±8 for VL^+ and VL^- dogs, respectively) and were significantly below from the baseline value in both groups. Respiratory rate varied considerably between individuals. The lowest rates measured at 60 min (21±1 and 21±3 breaths 1 min for VL^+ and VL^- dogs, respectively) did not differ significantly from baseline values. Body temperature was significantly altered during the anaesthetic period in both groups (Table 1).

Values for WBC RBC haemoglobin and haematocrit are shown in Table 2. Slight anaemia was also detected in

Table 1: Changes in heart rate respiratory rate and body temperature in VL^+ (infected with Leishmania infantum) and VL^- (uninfected with Leishmania infantum) dogs anaesthetized for an hour with propofol

Veriable	0 (baseline)	15	30	45	45	24 h
Heart rate (beats min^{-1})						
VL^+	115±4	97±8	102±4	92±3[a]	88+4[a]	105+4
VL^-	112±10	100±12	104±4	98±6	90±8[a]	101±4
Respiratory rate (breaths min^{-1})						
VL^+	21±3	29±5	29±5	21±2	21+1	22±2
VL^-	32±3	35±4	40±3	26±3	21±3	31±8
Rectal temperature (°C)						
VL^+	38.7±0.1	38.1±0.2[a]	37.7±0.2[b]	37.3±0.2[b]	37.1+0.2[b]	38.9±0.3
VL^-	38.8±0.1	38.5±0.1	38.1±0.4[a]	37.7±0.7[b]	37.2±0.8[b]	38.6±0.1
Mean arterial pressure (mmHg)						
VL^+		78±5	80±3	76±11	74±7	
VL^-		79±6	81±8	77±9	75±8	

Values are reported mean±S.D.; [a]Mean value differs significantly ($p<0.05$) from baseline value; [b]Mean value differs significantly ($p<0.05$) from VL^+

Table 2: Changes in selected biochemical and hematological values in VL^+ (infected with Leishmania infantum) and VL^- (uninfected with Leishmania infantum) dogs anaesthetized for an hour with propofol

Variable	0 (baseline)	15	30	45	60	24 h
WBC (10^9 L^{-1})						
VL^+	11.7±1.3	10.2±1.5	9.6±0.8	9.1±0.6	9.0±0.9	21.2±2.5[a]
VL^-	12.7±0.6	13.3± 2.7	12.4±2.2	13.2±2.0	14.2±2.5	26.4±3.1[a]
RBC (10^{12} L^{-1})						
VL^+	4.7±0.5	4.6±0.6	4.4±0.6	3.0±0.3[a]	3.4±0.5a	4.8±0.5
VL^-	7.5 ±1.8[b]	8.0 ±2.4[b]	7.4 ±1.6[b]	7.1±1.4[b]	6.8 ±1.4[ab]	7.7 ±1.6[b]
Hb (g dL^{-1})						
VL^+	11.5±1.8	11.3±1.5	9.9±1.2	9.2±1.0	8.1±0.9[a]	11.8±1.9
VL^-	15.5±2.8[b]	16.7±1.8[b]	14.9±1.6[b]	12.1±1.2[b]	11.5±1.8[ab]	16.0±2.5[b]
Haematocrit (L L^{-1})						
VL^+	0.32±0.04	0.32±0.04	0.29±0.03	0.26+0.03	0.24±0.04[a]	0.35±0.04
VL^-	0.45±0.04[b]	0.54±0.01[b]	0.44± 0.01[b]	0.40±0.04[b]	0.38±0.03[ab]	0.49±0.07[b]
Total protein (g L^{-1})						
VL^+	74±2	72±2	66±3	65±2	61±2	74±2
VL^-	56±2[b]	55±2[b]	54±2[b]	54 ±0.2[b]	46±2[b]	57±2[b]
Albumin (g L^{-1})						
VL^+	12±1	12±1	10±1	10±1	12±1	12±1
VL^-	32±1[b]	32±1[b]	31±1[b]	31±1[b]	30±1[b]	33±1[b]
Urea (mmol L^{-1})						
VL^+	4.6±0.7	4.8±0.7	4.9±0.6	4.9±0.7	5.0±0.7	4.7±0.7
VL^-	4.1±0.1[b]	4.2±0.2[b]	4.3±0.2[b]	4.3±0.3[b]	4.4±0.3[b]	4.1±0.3[b]
Creatinine (µmol L^{-1})						
VL^+	97±18	97±18	97±18	97±18	97±18	97±18
VL^-	88±15	97±18	101±18	97±18	97±18	88±15
AST (nkatL^{-1})						
VL^+	87±13	87±15	90±12	92±12	92±12	92±12
VL^-	77±10	67±8	104±8[a]	96±10	87±12	109±12[a]
ALT (nkatL^{-1})						
VL^+	37±3	37±9	37±3	38±3	38±3	38±5
VL^-	38±5	49±7	58±5	53±5	55±3	72±3[a]

Values are reported mean±S.D.; [a]Mean value differs significantly ($p<0.05$) from baseline value; [b]Mean value differs significantly ($p<0.05$) from VL^+

dogs with VL^+. Haemoglobin haematocrit and the number of RBC decreased significantly in both groups at 60 min of anaesthesia ($p<0.05$ for both groups) and had also returned to baseline 24 h after propofol administration (Table 2).

Values for serum albumin total protein urea creatinine AST and ALT are presented in Table 1. The baseline values of total protein in dogs with VL^+ (74±2 g L^{-1}) were significantly higher than the VL^- dogs (56±2 g L^{-1}; $p<0.05$). The serum albumin value in VL^- dogs (32±3 g L^{-1}) were significantly higher than that of the VL^+ dogs (12±1 g L^{-1}) before anaesthesia with propofol ($p<0.05$). Hyperproteinaemia and hypoalbuminaemia were detected in VL^+ dogs. The levels of serum albumin total protein urea creatinine did not change significantly over time for either groups during the study period. Statistically significant increases in serum AST were recorded at 30 min and 24 h in VL^- group (104±8 and 109±12 nkatL^{-1}; $p<0.05$). A significant increase in ALT was recorded at 24 h in group VL^- (72±3 nkatL^{-1}; $p<0.05$) (Table 2).

All animals were placed under controlled observations until they were clinically normal. No side effects were recorded in the following days. All dogs survived the propofol study period and complications did not developed.

DISCUSSION

Propofol (26 di-isopropyl phenol) an intravenous hypnotic agent has rapidly become established as a safe and effective induction and anaesthetic agent in dogs. Hall and Chambers (1987) first described the use of propofol for total intravenous anaesthesia in dogs and compared it with the use of halothane and nitrous oxide. They reported that an infusion rate of 0.4 mg/kg/min produced surgical anaesthesia. However, this was associated with more complications than halothane/ nitrous oxide anaesthesia. When propofol was used as the sole agent for total intravenous anaesthesia in humans it proved unsatisfactory for many surgical procedures because the doses required to prevent physical responses to major surgery induced cardiovascular and respiratory depression. Consequently when a balanced anaesthetic technique was used propofol was often administered concurrently with short-acting opioid analgesics such as fentanyl and alfentanil (Flecknell *et al*., 1990). Because propofol does not have marked analgesic effects and its metabolism is rapid we used fentanyl as a analgesic agent.

This investigation has demonstrated that a significant lower dose of propofol was required to induce and maintain anaeshesia for an hour in dogs with VL. It has been reported that more than 90% propofol molecules in the blood bind to protein and erythrocytes (Cockshot *et al*., 1992). Previous work by Johnson *et al*. (2003) has studying the influence of hemorrhagic shock on the pharmacokinetics and pharmacodinamics changes of propofol has demonstrated that hemorrhagic shock results in a decrease in the intercompartmental clearances and an increase in the potency of propofol. These pharmacokinetic and pharmacodinamic changes resulted in a 2.7-fold reduction in dose via continious infusion to achieve the same drug effect. In the present cases, the albumin concentration and the haemoglobin concentration had decreased owing to VL. The reduced albumin concentration and haemoglobin concentration may have resulted in a acute increase in the free fraction of propofol.

In this study was found that the recovery was rapid and uneventful in both groups. A low plasma albumin concentration may adversely influence the pharmacokinetics of agents that are highly protein bound e.g., digoxin non-steroidal anti-inflammatory drugs phenytoinbenzodiazepines opioids thiopental and propofol (Cockshot *et al*., 1992). In spite of all of these disorders in blood composition a rapid elimination of propofol and a smooth recovery from anaesthesia was seen. Diazepam and fentanyl have a short duration of action after IV or IM administration (Flecknell *et al*., 1990; Kilic, 2004) and would be expected to have little influence on recovery times.

Heart rates and respiratory rates remained within clinically acceptable limits in both groups. The use of atropine in conjunction with bolus administration of fentanyl during anaesthesia has been recommended to prevent bradycardia (Nolan and Reid, 1991). In this study, atropine was administered before fentanyl administration. The combination of propofol and fentanyl may predispose to bradycardia because propofol alone may induce bradycardia. This effect has also been recorded in other propofol infusion studies (Robertson *et al*., 1992).

Slight anaemia was also detected in dogs with VL^+. Haematocrit haemoglobin and the number of RBC decreased during propofol administration in both groups although, the effect had resolved by 24 h. The decrease in haemoglobin was in the order of 3.4-4 g dL^{-1} in VL^+ and VL^- groups, respectively. This change with anaesthesia has not been explained well, but it is seen with propofol infusions in dogs (Robertson *et al*., 1992). It is possible that the decrease may represent splenic sequestration or may be due to changes in peripheral circulation. The dogs did not receive fluids during the anaesthetic. It results in a reduction in red cell mass and a decrease in the oxygen-carrying capacity of the blood. Anaemia is assessed by

measuring the haemoglobin concentration or haematocrit. It therefore, reflects the relationship between circulating red cell mass and the plasma volume. During critical illness many factors can change acutely both these factors such that the presence of anaemia needs to be interpreted in relation to concurrent therapy and patho-physiology. The 'critical haemoglobin concentration' is usually defined as the concentration below which oxygen consumption is supply-dependent assuming normovolaemia is maintained (McLellan *et al*., 2003). Studies in dogs (van der Linden *et al*., 1998) have demonstrated this critical Hb concentration in animal models to be around 4 g dL^{-1}. In the present study the lowest Hb concentration was 81±0.9 at the end of the propofol anasethesia in VL^{+} group. This value is an acceptable Hb concentration in dogs during anaesthesia.

Similar to the previous findings (Hall and Chambers, 1997; Kilic, 2004) body temperature detected in this study, decreased gradually to the 37°C until 45 min and after this time it stayed relatively stable in both groups. Apnoea was a frequent adverse effect after propofol administration. A short duration of apnoea (20-30 sec) was observed in 4 dogs with VL and in 3 dogs of control group. Also, high incidence of apnoea of bot groups observed in this study is in accordance with the findings of previous investigators (Hall and Chambers, 1987; Kilic, 2004). Adverse effects attributed to propofol administration in dogs include signs of pain on injection salivation retching and vomiting during recovery (Hall and Chambers, 1987; Kilic, 2004). Contrary to these observations no side effects of propofol were seen in this study.

CONCLUSION

In conclusion results of this study suggest that diazepam-fentanyl-propofol combination can be used to induce anaesthesia in dogs with visceral leishmaniasis. However, haematocrit and haemoglobin concentration should be monitored closely.

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REFERENCES

Branson, K.R. and M.E. Gross, 1994. Propofol in veterinary medicine. J. Am. Vet. Med. Assoc., 204: 1888-1890. PubMed: 8077130.

Cavaliere, F., G. Conti and U. Moscato, 2005. Hypoalbuminemia does not impair Diprifusor performance during sedation with propofol. Br. J. Anaesth., 94: 453-458. DOI: 10.1093/bja/aei074, PubMed: 15665071. http://dx.doi.org/10.1093/bja/aei074.

Ciaramella, P., G. Oliva, R.P. De Luna, R. Ambrosio, L. Cortese, A. Scalone and A. Presechino, 1997. A retrospective clinical study of canine leishmaniasis in 150 dogs naturally infected with Leishmania infantum. Vet. Rec., 141: 539-543. PubMed: 9413121.

Cockshott, I.D., E.J. Dougles and G.F. Plummer, 1992. The pharmacokinetics of propofol in laboratory animals. Xenobiotica, 22: 369-379. PubMed: 1496826.

Dubey, P.K., P.K. Sinha and K.H. Raghwendra, 2001. Anesthetic considerations in a patient with visceral leishmaniasis. Can. J. Anesth., 48: 529-531. PubMed: 11444445.

Flecknell, P.A., A.J.B. Kirk and C.E.Fox , 1990. Long-term anaesthesia with propofol and alfentanil in the dog and its partial reversal with nalbuphine. J. Assoc. Vet. Anaesth., 17: 11-16. DOI: 10.1111/j.1467-2995.1990.tb00381.x.

Hall, L.W. and J.P. Chambers, 1987. A clinical trial of propofol infusion anaesthesia in dogs. J. Small Anim. Pract., 28: 623-637. DOI: 10.1111/j.1748-5827.1987.tb01277.x. PubMed: 3495923.

Johnson, K.B., T.D. Egan, S.E. Kern, J.L. White, S.W. McJames, N. Syroid, D. Whiddon and T. Church, 2003. The influence of hemorrhagic shock on propofol: A pharmacokinetic and pharm-acodynamic analysis. Anesthesiology, 99: 409-420. PubMed: 12883414.

Jüttner, C., M.R. Sanchez, E.R. Landeras, R.J. Slappendal and C.F. Arnold, 2001. Evaluation of the potential causes of epistaxis in dogs with natural visceral leishmaniasis. Vet. Rec., 11: 176-179. PubMed: 11530902.

Kilic, N., 2004. Comparison of fentanyl-acepromazine and fentanyl-diazepam as apremedicants in healthy dogs undergoing propofol anaesthesia. Indian Vet. J., 81: 727-728. IDS Number: 896DR.

Mauricio, L., K.M. Howard, R.J. Stolhard and A.M. Miles, 1999. Genomic diversity in the Leishmania donovani complex. Parasitology, 119: 237-246. DOI: 10.1017/S0031182099004710. PubMed: 10503249.

McLellan, S.A., D.B. McClelland and T.S. Walsh, 2003. Anaemia and red blood cell transfusion in the critically ill patient. Blood Rev., 17: 195-208. DOI: 10.1016/S0268-960X(03)00018-3. PubMed: 14556774.

Nolan, A.M. and J. Reid, 1991. The use of intraoperative fentanyl in spontaneously breathing dogs under-going orthopaedic surgery. J. Vet. Anaesth., 18: 30-34. DOI: 10.1111/j.1467-2995.1991.tb00009.x.

Ozensoy, S., Y. Ozbel, N. Turgay, M.Z. Alkan, K. Gul, A. Gilman Sachs, K.P. Chang, S.G. Reed and M.A. Ozcel, 1998. Serodiagnosis and epidemiology of visceral leishmaniasis in Turkey. Am. J. Trop. Med. Hyg., 59: 363-369. PubMed: 9749626.

Robertson, S.A., S. Johnston and J. Beemsterboer, 1992. Cardiopulmonary anaesthetic and postanaesthetic effects of intravenous infusions of propofol in greyhounds and nongreyhounds. Am. J. Vet. Res., 53: 1027-1032. PubMed: 1626771.

van der Linden, P., D. Schmartz, F.D. Groote, N. Mathieu, P. Willaert, I. Rausin and J.L. Vincent, 1998. Critical haemoglobin concentration in anaesthetized dogs: Comparison of 2 plasma substitutes. Br. J. Anaesth., 81: 556-562. PubMed: 9924232.