ACADEMIA | Letters

EFFECT OF SEDATION OR ANAESTHESIA ON ECHOCARDIOGRAPHIC PARAMETERS IN DOGS; A REVIEW

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Introduction

Echocardiography is the use of diagnostic ultrasound to assess the heart and proximal great vessels. It complements other diagnostic procedures by quantifying chamber dimensions, wall thicknesses, and the dynamic events of the cardiac cycle (Perera *et al.*, 2014). It permits viewing of the structure and motion of valves including congenital abnormalities such as defect in the interventricular septum, stenotic pulmonary valve e.t.c. Velocity of blood flow is also commonly measured while turbulent blood flow is identified with Doppler echocardiography. Subsequently, pressure gradients, blood flow volumes, and several indices of cardiac function can be calculated (Edler & Lindström, 2004).

Key reviews and controversies

A study investigated the echocardiographic changes during anaesthesia induction with diazepam-etomidate (DE), diazepam-ketamine (DK), Propofol (P) or ketamine-propofol (KP) in dogs sedated with acepromazine and butorphanol. Systolic blood pressure (SBP) was measured and echocardiography was performed immediately prior to the application of the sedation protocol (M0- baseline), 15 minutes after sedation (M1), and immediately after anesthesia induction (M2). No significant differences were observed in SBP and in haemodynamic variables such as cardiac index, shortening fraction, and ejection fraction,

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between groups at all-time points (M0, M1, and M2) evaluated. The SBP was significantly reduced after anaesthetic induction in the dogs with diazepam–etomidate (DE) and ketamine-propofol (KP) groups. It was concluded that the protocols DE and KP similarly reduced SPB while it remain stable after anaesthetic induction with DK and P. All anaesthetic induction with DK and P protocols maintained a stable cardiac index (CI) in premedicated dogs. None of the protocols evaluated promoted significant echocardiographic changes. Furthermore, the DK had a negative impact on myocardial relaxation (Cardoso *et al.*, 2018).

Propofol is one of the most widely used injectable anaesthetic agents in veterinary practice. Cardiovascular effects related to propofol use in dogs remain less well defined. A study evaluated the haemodynamic changes during induction of general anaesthesia with propofol in healthy dogs, by a beat-to-beat continuous monitoring. All dogs were premedicated with intramuscular acepromazine and methadone. Transthoracic echocardiography was used to measure the velocity time integral (VTI) of the left ventricular outflow tract. A syringe driver programmed to deliver propofol 5 mg/kg over 30 second (s) followed by a continuous infusion of 25 mg/kg/h was used to induce and maintain anaesthesia. From the onset of propofol administration, heart rate (HR) and mean invasive arterial blood pressure (MAP) were recorded every 5s for 300 s, while aortic blood flow was continuously recorded and stored for 300s. The lowest MAP (MAP T peak) recorded during the monitored interval was defined as the maximum cardiovascular depression. VTI and VTI*HR were calculated at 0, 30, 90, 120, 150 and 300s post administration of propofol and at MAP T peak. Conclusively, this study has found that a bolus of propofol administered IV over 30s causes a transitory drop in blood pressure in healthy premedicated dogs, However, the cardiac output was well maintained due to increase in heart rate (Cattai *et al.*, 2018).

Another study evaluated the effect of protocols with acepromazine and fentanyl on the echocardiographic parameters of healthy dogs. Their effect on systolic blood pressure (SBP), respiratory rate (RR), heart rate (HR), time spent for examination and sedation scale were also assessed. Ten adult dogs were subjected to different tranquilizing protocols 20 minutes before the echocardiographic examination. A total of five treatments (CT-control treatment, IAT - intramuscular acepromazine, OAT - oral acepromazine, FT - fentanyl and AFT - acepromazine associated with fentanyl) were performed at seven-day intervals between evaluations. The resul shows significant decrease of SBP in OAT, a significant reduction in left ventricular diameter during systole, diastole and mitral annular movement in IAT, OAT and AFT, compared with CT. There was a decrease in tricuspid annular plane systolic excursion and increase in mitral E/mitral A ratio in IAT and OAT when compared with CT.

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The FT does not cause changes in echocardiographic parameters. Decrease HR occurs in all protocols of tranquilization, which facilitate the echocardiographic examination (Santos *et al.*, 2018)..

The effects of alfaxalone (3 mg/kg, intravenously) on echocardiographic examination was assessed six in healthy Beagle. Left ventricular dimensions with systolic indexes, trans-blood flow at all cardiac valvular annulus and trans-mitral tissue Doppler values were measured from routine transthoracic echocardiography. Although the changes were not statistically significant, heart rate, left ventricular end-systolic diameter, left ventricular end-diastolic diameter, peak velocities of tricuspid A-wave and trans-pulmonic flow were increased after alfaxalone induction, while systolic blood pressure, fractional shortening, left ventricular ejection fraction, peak velocities of mitral E-wave, mitral A wave, tricuspid E-wave, transaortic flow and medial e'-, a'- and s'-peaks decreased after alfaxalone induction. Although alfaxalone showed mild cardiovascular depression during the study, the researcher concluded that it could be a good alternative sedative protocol for echocardiographic examination in healthy dogs because the cardiovascular depression was statistically and clinically insignificant. However, further studies in dogs with heart diseases should be conducted to confirm these findings after alfaxalone induction (Kim *et al.*, 2015).

Another study compared the cardiovascular effects of three different sedative protocols: medetomidine, acepromazine and their combination administered intravenously in healthy dogs at three different times; before (Tbase), at 15 (T15), 50 (T50) and 80 (T80) minutes after the administration of the drugs. The following non-invasive measurements were obtained: blood pressure with oscillometric method, electrocardiography, and echocardiography. Blood pressure and echocardiography showed decrease in left ventricular afterload secondary to acepromazine and an increase in right ventricular afterload due to medetomidine. The combination of the two drugs was able to mitigate the derangement of the left and right ventricular afterload produced by acepromazine and medetomidine, respectively. Moreover acepromazine prevented the AV blocks induced by medetomidine in the AM protocol. Medetomidine alone or in combination with acepromazine produced a significant reduction of heart rate and cardiac index as compared with acepromazine alone. All three protocols provided a similar and satisfactory level of sedation and a good recovery. The three protocols were eligible for sedation and premedication in healthy dogs. Moreover they had little impact on the echocardiographic variables evaluated in this study (Saponaro *et al.*, 2013).

Echocardiographic effects of isoflurane at an end-tidal concentration approximating 1.0 times the minimum alveolar concentration (MAC) was studied in healthy unpremedicated

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dogs. No changes were observed in heart rate. However, significant decreases were seen in left ventricular end-diastolic diameter, interventricular septal thickness during systole, interventricular septal thickening fraction, left ventricular free wall thickening fraction, ejection fraction, and fractional shortening. In addition, peak flow velocities across mitral, pulmonic, and aortic valves were significantly lower than baseline values. Decreases were also observed in end-diastolic left ventricular volume index, stroke index, and cardiac index when compared with awake measurements. It was concluded that 1 MAC isoflurane caused significant myocardial depression in healthy dogs. Therefore, there is need for careful consideration when isoflurane is to be used in dogs with poor cardiovascular reserve (Sousa *et al.*, 2008).

The effects of midazolam combined with morphine or butorphanol on echocardiographic variables of healthy dogs was studied by Geovana P in 2021. Twenty-four dogs of various breeds aged were enrolled in the study. Subjects were randomly allocated in one of two experimental groups of sedation with intramuscular midazolam (0.3 mg/kg) combined with butorphanol (0.2 mg/kg) (GB, n = 12) or morphine (0.3 mg/kg) (GM, n = 12). Transthoracic echocardiographic examinations comprised B-Mode, M-Mode, spectral Doppler and pulsed tissue Doppler assessment. Data were recorded before sedation (TB) and 20 minutes following intramuscular administration of either sedation protocol (TS). Data were analyzed using repeated measures ANOVA followed by Tukey's posthoc test. Shortening fraction, ejection fraction, left ventricular diameter and volume did not differ among groups and time points. The A and E′ waves were decreased in GM at TS compared to TB. Isovolumic relaxation time, Ae/Ao ratio, aortic and pulmonary flows and S′ wave did not differ among time points and groups. The result shows that these sedation protocols did not produce clinically relevant changes in echocardiographic variables, therefore can be used for sedation of uncooperative dogs during echocardiographic evaluation.

Conclusion

Regardless of the reported differential effects of anaesthetic agents on cardiac function and echocardiograms in dogs, much less is known about the impact of the choice of sedative or anaesthetic agent on the echocardiogram of healthy dogs and there is no report on effects of sedative or anaesthetic agent in dogs with cardiac disease (Kim *et al*., 2015; Santos *et al.*, 2018).

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Cardoso, H. M., Tocheto, R., Padilha, V. S., Silva, G., Comassetto, F., Andrade, J. N. B. M. de, & Oleskovicz, N. (2018). Echocardiographic evaluation of dogs subjected to different protocols of anesthetic induction TT - Avaliação ecocardiográfica de cães submetidos a diferentes protocolos de indução anestésica. *Ciência Rural*.

Cattai, A., Rabozzi, R., Ferasin, H., Isola, M., & Franci, P. (2018). Haemodynamic changes during propofol induction in dogs: new findings and approach of monitoring. *BMC Veterinary Research*, *14*(1), 282. https://doi.org/10.1186/s12917-018-1608-8

Edler, I., & Lindström, K. (2004). The history of echocardiography. *Ultrasound in Medicine & Biology*, *30*(12), 1565–1644. https://doi.org/10.1016/S0301-5629(99)00056-3

Kim, Y.-W., Kim, T.-J., & Hyun, C. (2015). Effects of alfaxalone on echocardiographic examination in healthy dogs. *Korean Journal of Veterinary Research*, *55*(4), 221–225. https://doi.org/10.14405/kjvr.2015.55.4.221

Lee, S. H., Choi, Y. S., Hong, G. R., & Oh, Y. J. (2015). Echocardiographic evaluation of the effects of dexmedetomidine on cardiac function during total intravenous anaesthesia. *Anaesthesia*, *70*(9), 1052–1059. https://doi.org/10.1111/anae.13084

Perera, P., Lobo, V., Williams, S. R., & Gharahbaghian, L. (2014). Cardiac Echocardiography. *Critical Care Clinics*, *30*(1), 47–92. https://doi.org/10.1016/j.ccc.2013.08.003

Santos, E. A., Aptekmann, K. P., Santos, P. O. P. R., Reis, A. C., Kuster, M. C. C., & Andrade Junior, P. S. C. (2018). Echocardiographic parameters in dogs treated with acepromazine and fentanyl. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia*, *70*(6), 1767–1774. https://doi.org/10.1590/1678-4162-10002

Saponaro, V., Crovace, A., De Marzo, L., Centonze, P., & Staffieri, F. (2013). Echocardiographic evaluation of the cardiovascular effects of medetomidine, acepromazine and their combination in healthy dogs. *Research in Veterinary Science*, *95*(2), 687–692. https://doi.org/10.1016/j.rvsc.2013.03.022

Sousa, M. G., Carareto, R., De-Nardi, A. B., Brito, F. L. C., Nunes, N., & Camacho, A. A. (2008). Effects of isoflurane on echocardiographic parameters in healthy dogs. *Veterinary Anaesthesia and Analgesia*, *35*(3), 185–190. https://doi.org/10.1111/j.1467-2995.2007.00370.x

Ward, J. L., Schober, K. E., Fuentes, V. L., & Bonagura, J. D. (2012). Effects of sedation on echocardiographic variables of left atrial and left ventricular function in healthy cats. *Journal of Feline Medicine and Surgery*, *14*(10), 678–685. https://doi.org/10.1177/1098612X12447729

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