

CARDIAC ARRHYTHMIAS IN GASTRIC DILATATION-VOLVULUS

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ABSTRACT

The aim of the present retrospective study was to analyze the prevalence and types of cardiac arrhythmias in gastric dilatation volvulus. The survey included 14 canine patients at various age, sex and breed. The total prevalence of arrhythmias in the studied canine population was 42.8% (6/14). Arrhythmias are among the pre-disposing factors which lead to increased mortality in this acute condition. Discussion of the possible etiology of reported electrocardiographic changes was performed.

Key words: ECG, arrhythmia, canine, dilatation, volvulus.

Introduction

Gastric dilatation-volvulus (GDV) is an emergency canine disorder which requires a comprehensive surgical and intensive therapeutic approach (Broome and Walsh, 2003). It is diagnosed mainly in large and giant-breed dogs. Although it can affect all age groups elderly patients are at increased risk. Overall mortality was 18% (24/137) according to (Brouman et al., 1996).

Gastric distention and/or torsion leads to compression of the surrounding organs, compromised cardiac function and blood circulation, impaired gastric perfusion with ischemic damage of the tissues, followed by possible reperfusion injury. Pathophysiology of GDV includes a complex of water, electrolyte and acid-base disorders which can increase lethality (Matthieson, 1993).

Cardiovascular monitoring (e.g. ECG) of canine gastric dilatation-volvulus patients should be part of the integral diagnostic approach (Homer, 2020). Cardiac disturbances are among the common accompanying complications in the course of disease. Arrhythmias, hypotension and various electrophysiological alterations like P wave changes, PR period prolongation and ST elevation or suppression are among the possible findings. Ventricular arrhythmias are frequently reported (Beck et al., 2006). Ventricular premature complexes (VPCs) and ventricular tachycardia (VT) are the most common. This complication is a serious factor which can promote mortality (Mackenzie et al., 2010).

Materials and methods

Study animals – fourteen (n=14) dogs with clinical and radiographic signs of GDV were included. These were of different breeds (German Shepherd dog – n=8, Central Asian Shepherd dog – n=2, mongrel dogs – n=4). Mean age was 9.2 years (range 2 to 14 years), mean body weight was 38.5 kg (range 20 to 65 kg), male dogs – n= 10, female – n=4. All patients had no data about concurrent cardiac diseases. They were chosen from the canine emergency population of a Small Animal Clinic in Sofia, Bulgaria.

ECG recording – the electrodes were placed in forelimbs and hindlimbs according to Tilley (1992), in standing position or right lateral recumbency without sedation. The six frontal plane leads were continuously recorded at a velocity of 50 mm/s (1 mm = 0.1 mV, 1 mm = 0.02 s). The arrhythmia criteria for analysis were established by Smith et al. (2015).

Results

The total prevalence of arrhythmias in the studied canine population was 42.8% (6/14). All of the recorded arrhythmias were of ventricular origin. VPCs were detected in 14.3% (2/14) (Fig. 1) and VT – in 28.6% (4/14) (Fig. 2). Four of the positive dogs were male (two – German Shepherd dog and two mongrel dogs) and two – female (German Shepherd dog). The mean age of the animals with arrhythmias was 10 years (range 9 to 11 years).



**Figure 1: VPCs (ventricular bigeminy) in a 9 years old German Shephard dog with GDV.
(50 mm/s, 10 mm/mV, HR 113 bpm)**



**Figure 2: VT in a 6 years old mongrel dog with GDV, followed by normal sinus rhythm.
(50 mm/s, 10 mm/mV, HR 208 bpm)**

Discussion

Cardiac arrhythmias should be considered as a significant diagnostic and prognostic finding in surgical and critically ill patients. Results of Duerr et al. (2007) showed that notable arrhythmias, like atrioventricular block, atrial premature complexes, ventricular premature complexes, can occur in the perioperative period in young, healthy dogs undergoing even routine anaesthesia and surgeries.

Arrhythmias in GDV are commonly observed pre- and postoperatively. However, they are seen more often in the reanimation period. Periodic ventricular arrhythmia normally begins 12–36 hours after surgery. Approximately 43% of cases with gastric distention or volvulus develop cardiac arrhythmias that can contribute to mortality (Miller et al., 2000). This is comparable to the result of the current study. Etiology is not certain, but a myocardial depressant factor, reduced cardiac output, and myocardial ischemia may be contributing factors (Thongkorn, 2012). Coronary blood flow alteration can further contribute to myocardial oxygen insufficiency (Horne et al., 1985). Another possible mechanism for the generation of arrhythmias is excluded in the study of Bebchuk et al. (2000). Their conclusion is that Mg does not play a role in cardiac arrhythmias in patients with GDV.

Dogs should be treated with antiarrhythmic agents only if the arrhythmia is found to be related to poor tissue perfusion, if preexisting cardiac disease is present or when a persistent multiform ventricular VPCs or VT is detected. Lidocaine should be the preferred drug (Bruchim et al., 2012).

Dynamic ECG changes can be detected also in human patients with gastric distention or intestinal obstruction (Frais and Rodgers, 1990; Jawa et al., 2013). ST elevations typical for acute coronary syndrome could be observed and some of the possible explanations are the change in the position of the heart in the thoracic cavity secondary to gastric distention, elevated vagal tone due to pain causing coronary artery spasms or stress-related catecholamine-associated cardiomyopathy (Herath et al., 2016).

Conclusion

Cardiac arrhythmias are a common accompanying finding in canine patients with GDV. According to the references and to our results there are usually of ventricular origin and can possess negative impact to the hemodynamics and the clinical outcome.

References

1. Bebchuk T., Hauptman J., Braselton E., Walshaw R. (2000). *Intracellular magnesium concentrations in dogs with gastric dilatation-volvulus*. American Journal of Veterinary Research, November, Vol. 61, No. 11, Pages 1415–1417.
2. Beck J., Staatz A., Pelsue D., Kudnig S., MacPhail C., Seim H.3rd, Monnet E. (2006). *Risk factors associated with short-term outcome and development of perioperative complications in dogs undergoing surgery because of gastric dilatation-volvulus: 166 cases (1992–2003)*. J Am Vet Med Assoc. Dec 15; 229(12):1934–9.
3. Broome C., Walsh V. (2003). *Gastric dilatation-volvulus in dogs*. New Zealand Veterinary Journal, 51:6: 275–283.
4. Brouman J., Schertel E., Allen D., Birchard S., DeHoff W. (1996). *Factors associated with perioperative mortality in dogs with surgically managed gastric dilatation-volvulus: 137 cases (1988–1993)*. J Am Vet Med Assoc; 208:1855–1858.
5. Bruchim Y., Itay S., Shira B., Kelmer E., Sigal Y., Itamar A., Gilad S. (2012). *Evaluation of lidocaine treatment on frequency of cardiac arrhythmias, acute kidney injury, and hospitalization time in dogs with gastric dilatation volvulus*. J Vet Emerg Crit Care (San Antonio). Aug; 22(4):419–27.
6. Duerr F., Carr A., Duke T., Shmon C., Monnet E. (2007). *Prevalence of perioperative arrhythmias in 50 young, healthy dogs*. Can Vet J;48: 169–177.
7. Frais M., Rodgers K. (1990). *Dramatic electrocardiographic T-wave changes associated with gastric dilatation*. Chest. 98:489–90.

8. Herath H., Matthias A., Keragala B., Udeshika W., Kulatunga A. (2016). *Gastric dilatation and intestinal obstruction mimicking acute coronary syndrome with dynamic electrocardiographic changes*. BMC Cardiovascular Disorders 16:245.
9. Homer A. (2020). *Cardiovascular monitoring of the canine gastric dilatation volvulus patient*. Veterinary Nurse, Vol. 11, No 1.
10. Horne W., Gilmore D., Dietze A., Freden G., Short C. (1985). *Effects of gastric distention-volvulus on coronary blood flow and myocardial oxygen consumption in the dog*. Am J Vet Res. Jan; 46(1):98–104.
11. Jawa R., Easley A., Anderson D. (2013). *Acute ST segment elevation secondary to acute gastric distention*. J Cardiol Cases; 8:108–12.
12. Mackenzie G., Barnhart M., Kennedy S., DeHoff W., Schertel E. (2010). *A retrospective study of factors influencing survival following surgery for gastric dilatation-volvulus syndrome in 306 dogs*. J Am Anim Hosp Assoc. Mar-Apr; 46(2):97–102.
13. Matthieson D. (1993). *Pathophysiology of gastric dilatation-volvulus*. In: Bojrab MJ, ed. Disease Mechanisms in Small Animal Surgery. Philadelphia, PA: Lea and Febiger; 220–231.
14. Miller T., Schwartz D., Nakayama T., Hamlin R. (2000). *Effects of Acute Gastric Distention and Recovery on Tendency for Ventricular Arrhythmia in Dogs*. J Vet Intern Med; 14: 436–444.
15. Smith F., Tilley L., Oyama M., Sleeper M. (2015). *Manual of Canine and Feline Cardiology*. 5th Edition, Saunders, ISBN: 9780323188029.
16. Thongkorn K. (2012). *A 6-year Retrospective Study of Canine Gastric Dilatation-Volvulus Treated with Incorporating Gastropexy*. PhD Thesis, Freien Universität Berlin. Journal-Nr. 3588. 24–27.
17. Tilley L. (1992). *Essentials of canine and feline electrocardiography*. 3rd Edition, Philadelphia, Lea and Febiger. 1–252.