

Isolated dextrocardia with *situs solitus* in a dog - case report

Dextrocardia isolada com *situs solitus* em um cão - relato de caso

Cris Rangel de Abreu¹, Maicon Roberto Paulo², Ana Luiza de Souza Andretta³ & Liz Andréa Villela Baroncini^{4*}

¹Veterinarian, Programa de Pós-graduação em Medicina Veterinária (PPGMV), Departamento de Cirurgia, Universidade Federal do Paraná, Curitiba, PR, Brazil

²Veterinarian, MSc, Programa de Pós-Graduação em Ciência Animal (PPCA), Escola de Ciências Agrárias e Medicina Veterinária, Pontifícia Universidade Católica do Paraná, Curitiba, PR, Brazil

³Veterinarian DSc, Veterinarian Autonomus, Curitiba, PR, Brazil

⁴Undegraduate in Veterinary Medicine, Universidade Positivo, Campus Ecoville, Curitiba, PR, Brazil

Abstract

Dextrocardia with *situs solitus* is a rare disorder caused by embryological malformation. It may be asymptomatic and overlooked when isolated, or when it presents with different symptoms and clinical signs associated with other cardiac and extracardiac malformations. The present article describes the radiologic, electrocardiographic, and echocardiographic findings of a Pitbull dog with isolated dextrocardia and *situs solitus*.

Keywords: echocardiography, electrocardiography, dextrocardia.

Resumo

A dextrocardia com *situs solitus* é uma condição rara decorrente de malformação embriológica. Pode ser assintomática e passar despercebida quando isolada ou apresentar diferentes sintomas e sinais clínicos quando associada a outras malformações cardíacas e extracardíacas. O presente artigo descreve os achados clínicos, radiológicos, eletrocardiográficos e ecocardiográficos encontrados em um cão da raça Pitbull com Dextrocardia isolada com *situs solitus*.

Palavras-chave: ecocardiografia, eletrocardiografia, dextrocardia.

Introduction

Dextrocardia is an embryologic anomaly caused by congenital malposition, in which there is a displacement of the major axis (base-apex) of the heart to the right side of the chest with a reversion of the apical inclination. It may be associated with other cardiac or extracardiac anomalies such as tracheoesophageal fistula, pulmonary hypoplasia, imperforate anus, spina bifida, and Kartagener syndrome (Faig-Leite & Faig-Leite, 2008). Studies in humans have reported that only 10% of the population affected by dextrocardia does not present relevant cardiac pathologies. However, almost 100% present with associated congenital cardiac anomalies (Rapoport et al., 2015). The current literature does not report statistics regarding this anatomical variation in dogs but only isolated case reports (Almeida et al., 2012; Mello et al., 2018). Nevertheless, the positioning of the heart predominantly in the right hemithorax should be elucidated, as it may also be caused by abnormalities of the nearby structures (dextroposition), which substantially impact daily veterinary clinical practice. Hence, this study aimed to report and describe the electrocardiogram (ECG), chest X-ray, and transthoracic echocardiography (TTE) findings of isolated dextrocardia with *situs solitus*, identified in the clinical evaluation of a Pitbull breed dog.

Case description

A female spayed Pitbull, approximately 15 years of age and vaccinated, was seen at the Veterinarian Hospital of Curitiba in the State of Paraná. The current clinical history presented complaints of mobility impairment, coughing, and the presence of tumors in the perineal region with alopecic areas in the tail, without the use of medication. Physical examination revealed an overall regular health status, normocolored mucosa, and tumors of approximately 10 cm in the perineal region. Cardiac auscultation revealed regular and normophonetic heart sounds in the right hemithorax with no heart murmurs. Laboratory examinations, chest radiography,



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*Correspondence

Liz Andréa Villela Baroncini
Universidade Positivo
Rua Pedro Viriato Parigot de Souza, 5300,
Campus Ecoville, CEP 81280-330,
Curitiba-PR, Brasil
E-mail: lizbaroncini@gmail.com

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and preoperative cardiologic evaluations were performed for tumor excision. Blood laboratory examination did not reveal any significant changes.

Chest radiography revealed a preserved tracheal lumen and pathway, unaltered esophageal region, unaltered mediastinum, enlarged cardiac silhouette and misplacement of the cardiac apex to the right hemithorax (suggestive of cardiopathy or dextrocardia), lung zones with diffuse bronchial opacification, pulmonary veins with no alteration, free costophrenic angles, radiographically preserved rib cage, preserved diaphragm, and a gas bubble in the stomach to the left (Figures 1-3).

ECG at the standard electrode position with seven leads (one precordial lead) revealed a sinus rhythm with physiological sinus arrhythmia, heart rate of 100 bpm, frontal cardiac axis deviation to the right, elevated P-wave, higher T-wave, complete block of the right branch, and intermittent first-degree atrioventricular block (Figure 4).

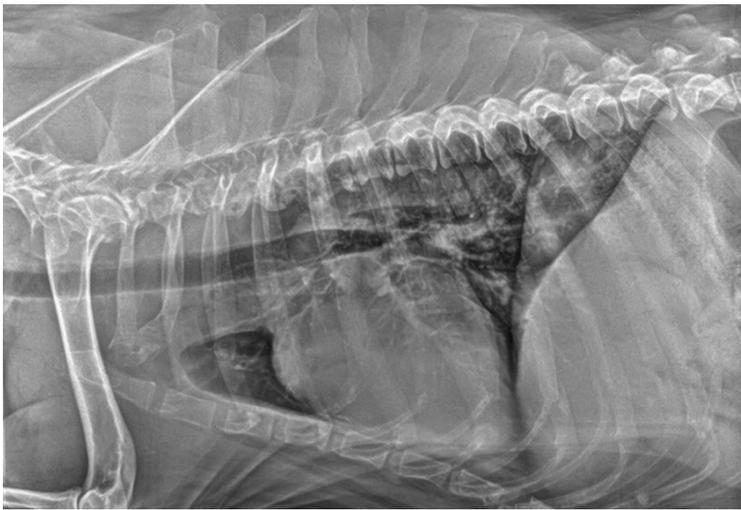


Figure 1. Chest X-ray: left lateral view.



Figure 2. Chest X-ray: ventrodorsal view.



Figure 3. Chest X-ray: right lateral view.



Figure 4. Electrocardiogram. 50 mm/s; 5 mm/mV (N/2).

TTE revealed dextrocardia, *situs solitus*, borderline left ventricle internal dimensions, normal global and regional systolic function, grade I diastolic dysfunction, and impaired relaxation. Valve flows showed mild tricuspid and pulmonary regurgitation and minimal mitral regurgitation. The right ventricular- right atrium gradient was 24 mmHg (normal), with a normal left atrium and right chambers. No atrioventricular or ventriculoarterial discordance or other intra- and extracardiac malformations were found (Figures 5-7).

Abdominal ultrasound was not performed; however, the gas bubble in the stomach was located to the left, identified on chest X-ray, indicating the regular position of the abdominal viscera (*situs solitus*, Figure).

The patient was cleared for surgery, and the histopathological results of the surgical piece revealed a mastocytoma with possible distant metastasis due to the presence of intravascular mastocytes.

Discussion

This reported case showed dextrocardia with *situs solitus* and the absence of other cardiologic alterations. The dog's normally structured heart, with no associated malformations, enabled its survival and longevity (Edzie et al., 2019; Perloff & Child, 1991).

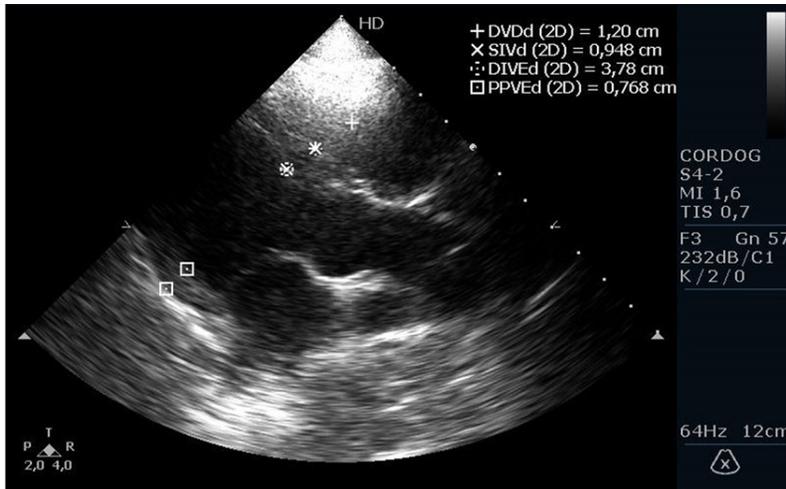


Figure 5. Echocardiogram: parasternal long-axis view in diastole (right hemithorax).

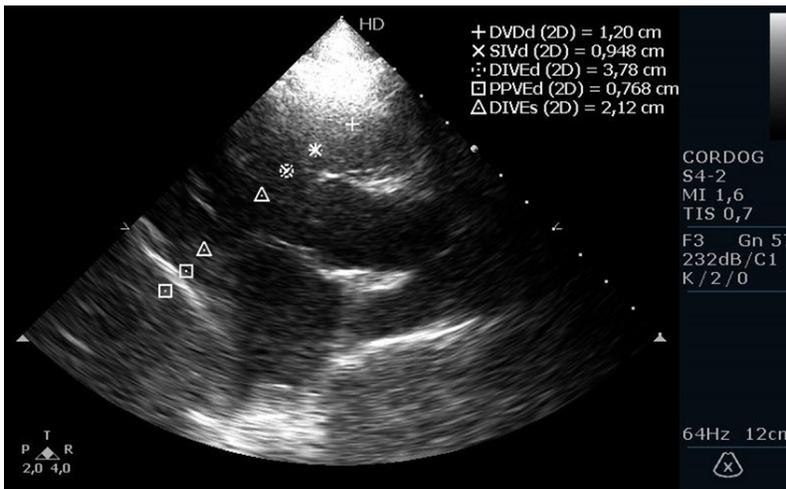


Figure 6. Echocardiogram: parasternal long-axis view in systole (right hemithorax).

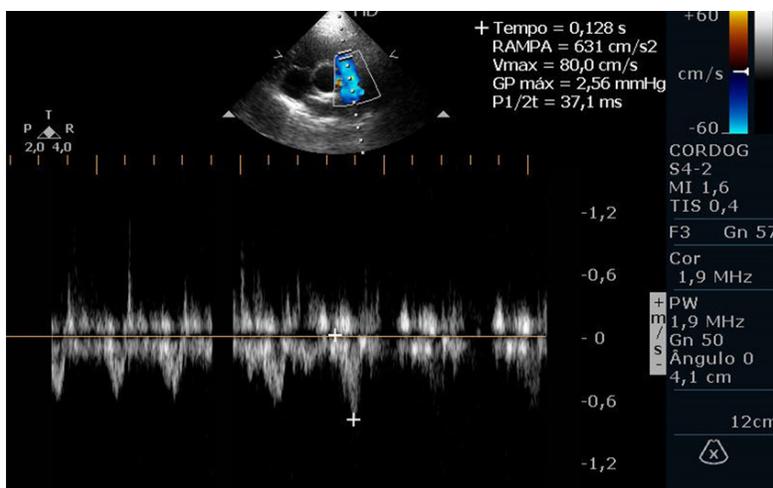


Figure 7. Parasternal short-axis view showing spectral Doppler of right ventricular outflow tract and pulmonary artery.

The term “dextrocardia” indicates that the heart is primarily located in the right hemithorax. It should be differentiated from dextroposition, in which the heart is located to the right owing to the presence of contents that take up the left hemithorax or absence of lung volume to the right, and dextroversion, in which the cardiac apex fails to rotate to the left. The latter is frequently associated with atrioventricular discordance (Snider et al., 1997). Additionally, dextrocardia may be associated with *situs inversus totalis*, characterized by mirror-image transposition of both the thoracic and abdominal viscera, as well as the presence of Kartagener syndrome (*situs inversus totalis*, chronic sinusitis, and bronchiectasis) (Ortega et al., 2007; Souza Junior et al., 2011). These possible alterations should be investigated whenever a dog presents with dextrocardia associated with other clinical findings and symptoms.

In this context, thoracic radiography is fundamental in the initial cardiovascular evaluation and one must consider the characteristics of possible differential diseases and diagnoses, assessed by means of anamnesis and clinical examinations. Nevertheless, it is worth mentioning that isolated radiographic studies, without considering the clinical history and other examinations, may not provide a safe diagnosis (Tilley & Goodwin, 2002). In dogs that do not present with cardiac failure, the radiographic examination of cardiac disease focuses on investigating the size and shape of the cardiac silhouette. When enlarged, it may be due to the dilation of a single or all cardiac chambers. Identifying such conditions will lead to more precise diagnosis and clinical reasoning (Lamb et al., 2001). In the present case, the diagnosis of dextrocardia on chest radiography enabled more detailed cardiac evaluation.

ECG is also important in such cases. If it is performed or interpreted by inexperienced professionals, it may lead to incorrect results, and patients may therefore be treated incorrectly. A very frequent error in ECG is the wrong or inverted position of the peripheral electrocardiography leads, providing incorrect results and interpretations, including the deviation of the cardiac axis to the right, suggesting pulmonary hypertension or even dextrocardia (Rosen et al., 2014). Dextrocardia presents with specific ECG findings, which may cause problems, leading to incorrect diagnosis and unnecessary cardiac procedures. The main findings on ECG in dextrocardia include a) global negativity in lead I (negative P wave, QRS complex, and T wave), b) positively deflected QRS complex in aVR, c) negative P-wave in lead II, d) reverse R-wave progression in precordial leads, and e) right axis deviation (Winter, 2020). The main findings in the present case were predominantly a negative lead I, a positive QRS complex in aVR, a right-deflected axis, total right branch block, intermittent first-degree atrioventricular block, prolonged P-wave duration, and increased T-wave amplitude. These findings may also suggest an overload of the right chambers or pulmonary hypertension, which were excluded when they were analyzed along with other diagnostic methods performed in this patient.

In this case, TTE was essential to exclude other cardiac abnormalities besides dextrocardia, thereby clearing the patient for the recommended surgical procedure. The initial evidence was provided by routine chest radiography. Besides the thoracic radiograph being very oblique, there were no other images or contents that took up the left hemithorax or an absence of lung volume to the right, which could justify the major displacement of the cardiac image in the right hemithorax. In addition, upon clinical examination of the patient, evident heart sounds were noted in the right hemithorax. The echocardiographic probe found no images on the left side of the thorax; therefore, the probe was positioned just to the right of the sternum, and the cardiac apex was assessed on the right of the midline. No images were obtained from the left side of the thorax. The first image was of a parasternal long-axis view on the right side of the sternum, which showed no abnormalities (Figures 5, 6). The other views (short axis and apical 4- and 2-chambers) were normal. Therefore, dextrocardia was the only obvious alteration on ECG.

In daily veterinary practice, in both in cardiac preoperative evaluations for several surgeries and in preventive approaches, ECG and echocardiography have been increasingly used as fundamental tools in the prevention of cardiac events. Nevertheless, we emphasize the importance of performing both laboratory and preoperative cardiological examinations, as this medical management will enable the identification of possible anesthetic complications and those related to the surgical procedure itself (Cardoso et al., 2018).

Conclusion

The clinical case of isolated dextrocardia with *situs solitus* reported in this study had no major complications.

Ethics statement

All procediments were consented by the animal owner and by the veterinarian responsible for animal evaluation.

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None

Conflict of interests

No conflict of interests declared concerning the publication of this article.

Authors' contributions

CRA, MRP, ALSA and LAVB - Development of methodology; preparation and writing the initial draft, writing, review and editing manuscript

Availability of complementary results

Open multidisciplinary repository - access type: open

<http://data.4tu.nl/repository>

https://wp.scielo.org/wp-content/uploads/Lista-de-Repositorios-Recomendados_pt.pdf

The study was carried out at Hospital Veterinário São Bernardo, Curitiba, PR, Brazil

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