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Evaluation of heart murmurs in chinchillas (*Chinchilla lanigera*): 59 cases (1996–2009)

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Objective—To determine the prevalence of heart murmurs in chinchillas (*Chinchilla lanigera*) and determine whether heart murmurs were associated with cardiac disease.

Design—Retrospective multi-institutional case series.

Animals—260 chinchillas.

Procedures—Medical records of all chinchilla patients evaluated at the Tufts University Foster Hospital for Small Animals between 2001 and 2009, the University of California-Davis William R. Pritchard Veterinary Medical Teaching Hospital between 1996 and 2009, and the University of Wisconsin Veterinary Medical Teaching Hospital between 1998 and 2009 were reviewed.

Results—Prevalence of heart murmurs was 23% (59/260). Of 15 chinchillas with heart murmurs that underwent echocardiography, 8 had echocardiographic abnormalities, including dynamic right ventricular outflow tract obstruction, mitral regurgitation, hypertrophy of the left ventricle, tricuspid regurgitation, and hypovolemia. Echocardiographic abnormalities were approximately 29 times as likely (OR, 28.7) to be present in chinchillas with a murmur of grade 3 or higher than in chinchillas without a murmur.

Conclusions and Clinical Relevance—Results suggested that heart murmurs are common in chinchillas and that chinchillas with heart murmurs often have echocardiographic abnormalities, with valvular disease being the most common. On the basis of these results, we believe that echocardiography should be recommended for chinchillas with heart murmurs, especially older chinchillas with murmurs of grade 3 or higher. Further prospective studies are needed to accurately evaluate the prevalence of cardiac disease in chinchillas with heart murmurs. (*J Am Vet Med Assoc* 2012;241:1344–1347)

Chinchillas (*Chinchilla lanigera*) are common companion animals in the order Rodentia.¹ The mean life span of 10 years is much longer than that of many other pet rodents, and some chinchillas are reported to have lived up to 20 years.² This relative longevity may predispose chinchillas to the development of degenerative diseases, including cardiac disease.

Information regarding cardiac disease in chinchillas is scarce, but dilated cardiomyopathy, congenital septal defects, and degenerative valvular disease have been reported.³ Heart murmurs of various intensities have been described in chinchillas and are considered

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ABBREVIATION

CI Confidence interval

a common finding on routine examination.^a To our knowledge, however, there are no published data with respect to the prevalence of cardiac disease in chinchillas nor data regarding the relationship between the presence of a heart murmur and underlying cardiac disease.^{4,5} On the other hand, use of echocardiography in chinchillas has been described, and reference ranges for echocardiographic variables in chinchillas have been published.⁶

The purpose of the study reported here was to determine the prevalence of heart murmurs in chinchillas and to determine whether heart murmurs were associated with cardiac disease in this species. On the basis of information available in the literature, we hypothesized that heart murmurs occur frequently in chinchillas but that most murmurs are not associated with cardiac disease.

Material and Methods

Medical records of all chinchillas examined at the Tufts University Foster Hospital for Small Animals between 2001 and 2009, the University of California-Davis William R. Pritchard Veterinary Medical Teaching Hospital between 1996 and 2009, and the Univer-

sity of Wisconsin Veterinary Medical Teaching Hospital between 1998 and 2009 were reviewed retrospectively. Age and sex of the animals were recorded, along with information on history and results of the initial physical examination. In all animals, history was elicited and the initial physical examination was performed by faculty members, small animal interns, or residents or interns associated with a zoological companion animal clinical service. Heart murmurs were graded on a scale of 1 to 6, as defined for other small mammals.⁷

When available, results of diagnostic testing for cardiovascular disease were recorded. Radiography had been performed with physical restraint, sedation, or anesthesia, and radiographs were reviewed by board-certified radiologists at each institution. Electrocardiography was performed with manual restraint; electrodes were positioned as described for small animals. Echocardiography was performed with manual restraint; all examinations were performed by a board-certified veterinary cardiologist or resident in veterinary cardiology.

Data were analyzed by the Service of Biostatistics and Epidemiology at Gustave Roussy Institute, Villejuif, France. Descriptive statistics were determined for age, clinical signs (ie, presence of decreased activity and

respiratory signs), murmur grade, and results of thoracic radiography and echocardiography. A χ^2 test was used to compare qualitative variables between centers. The prognostic role of each variable was evaluated by means of univariate logistic regression stratified by center. For variables with ordered categories, a χ^2 test for trends was also performed. All tests were 2 sided. Values of $P < 0.05$ were considered significant.

Results

A total of 260 chinchillas were examined at the 3 participating institutions during the study period. Overall, there were 153 (59%) males and 106 (41%) females (Table 1; sex of 1 animal was not reported in the record). Median age was 3 years (range, 0.5 to 17 years). Sex and age distributions did not differ significantly among the 3 participating institutions. A heart murmur was auscultated in 59 of the 260 (23%; 95% CI, 18% to 28%) chinchillas.

Seventy-two chinchillas underwent radiography, of which 15 had a heart murmur; 15 underwent echocardiography, of which all 15 had a heart murmur; and 5 underwent electrocardiography, of which 1 had a heart murmur (Table 2). Of the 15 chinchillas with a

Table 1—Signalment and clinical findings in 260 chinchillas (*Chinchilla lanigera*) evaluated at Tufts University between 2001 and 2009, the University of California-Davis between 1996 and 2009, and the University of Wisconsin between 1998 and 2009.

Variable	University of California-Davis (n = 125)	University of Wisconsin (n = 98)	Tufts University (n = 37)	All (n = 260)
Sex				
Male	79 (63)	53 (54)	21 (57)	153 (59)
Female	46 (37)	45 (46)	15 (41)	106 (41)
Not reported	0 (0)	0 (0)	1 (3)	1 (< 1)
Age (y)				
< 2	30 (24)	41 (42)	14 (38)	85 (33)
2–3	28 (22)	18 (18)	4 (11)	50 (19)
4–5	21 (17)	18 (18)	6 (16)	45 (17)
6–7	6 (5)	13 (13)	10 (27)	29 (11)
≥ 8	14 (11)	8 (8)	3 (8)	25 (10)
Not reported	26 (21)	0 (0)	0 (0)	26 (10)
Heart murmur				
None	103 (82)	65 (66)	33 (89)	201 (77)
Grade 1	4 (3)	0 (0)	1 (3)	5 (2)
Grade 2	7 (6)	11 (11)	2 (5)	20 (8)
Grade 3	9 (7)	16 (17)	0 (0)	25 (9)
Grade 4	2 (2)	4 (4)	1 (3)	7 (3)
Grade 5	0 (0)	2 (2)	0 (0)	2 (1)

Data are number (%).

Table 2—Diagnostic tests performed for cardiac evaluation in the same chinchillas as in Table 1.

Variable	University of California-Davis	University of Wisconsin	Tufts University	All
None	82 (66)	72 (73)	27 (73)	181 (70)
Radiography only	33 (26)	22 (22)	6 (16)	61 (23)
Radiography and echocardiography	7 (6)	2 (2)	0 (0)	9 (3)
Echocardiography only	2 (2)	2 (2)	0 (0)	4 (2)
Electrocardiography and echocardiography	0 (0)	0 (0)	2 (5)	2 (1)
Radiography and electrocardiography	1 (1)	0 (0)	1 (3)	2 (1)
Electrocardiography only	0 (0)	0 (0)	1 (3)	1 (0)

Data are number (%).

Table 3—Evaluation of factors potentially associated with detection of echocardiographic abnormalities in the chinchillas in Table 1.

Variable	Echocardiographic abnormality		OR (95% CI)	P value
	Yes (n = 8)	No* (n = 252)		
Participating institution				0.36
Tufts University	2 (25)	35 (14)	4.0 (0.5–35.2)	
University of California-Davis	5 (63)	120 (48)	5.5 (0.5–63.1)	
University of Wisconsin	1 (13)	97 (38)	Referent	
Sex				0.58
Male	5 (63)	148 (59)	Referent	
Female	2 (25)	104 (41)	0.6 (0.1–3.3)	
Not reported	1 (13)	0 (0)	NA	
Age (y)				0.50†
< 2	1 (13)	84 (33)	Referent	
2–3	1 (13)	49 (19)	1.4 (0.09–23.99)	
4–5	2 (25)	43 (17)	3.5 (0.3–39.6)	
6–7	2 (25)	27 (11)	6.1 (0.5–73.3)	
≥ 8	2 (25)	23 (9)	5.9 (0.5–68.5)	
Heart murmur‡				0.002§
None	2 (25)	199 (79)	Referent	
Grade 1 or 2	2 (25)	23 (9)	10.6 (1.4–79.4)	
Grade 3, 4, or 5	4 (50)	30 (12)	28.7 (4.4–188.2)	

Data are No. (%).
 *Results of echocardiography were negative (n = 7) or echocardiography was not performed (245). †P value for a trend = 0.07. ‡When the analysis was not stratified by participating institution (ie, when the populations of the 3 participating institutions were considered to be similar), the corresponding ORs were 8.7 and 13.2 (P = 0.01). §P value for a trend < 0.001 (R² = 0.05).
 NA = Not applicable.

heart murmur that underwent echocardiography, 8 had echocardiographic abnormalities. Of these, 2 had severe mitral regurgitation and dynamic right ventricular outflow tract obstruction, 1 had hypertrophy of the left ventricle and dynamic right ventricular outflow tract obstruction, 2 had mitral regurgitation, 1 had tricuspid regurgitation, 1 had dynamic right ventricular outflow tract obstruction only, and 1 had hypovolemia. Of the 8 chinchillas with echocardiographic abnormalities, 5 underwent radiography (2 had radiographic evidence of cardiomegaly) and 2 underwent electrocardiography.

Presence of a heart murmur was significantly associated with echocardiographic detection of a cardiac abnormality (Table 3). Echocardiographic abnormalities were 28.7 (95% CI, 4.4 to 188.2) times as likely to be present in chinchillas with a heart murmur of grade 3 or higher as in chinchillas without a heart murmur and were 10.6 (95% CI, 1.4 to 79.4) times as likely to be present in chinchillas with a heart murmur of grade 1 or 2 as in chinchillas without a heart murmur. However, echocardiographic abnormalities were not significantly more likely (OR, 2.7; 95% CI, 0.4 to 18.4) to be present in chinchillas with a heart murmur of grade 3 or higher as in chinchillas with a heart murmur of grade 1 or 2.

Discussion

Results of the present study suggested that heart murmurs are common in chinchillas, with 59 of the 260 (23%) chinchillas examined having a heart murmur. Although echocardiography was performed in only 15 animals with a heart murmur, 8 had echocardiographic abnormalities that accounted for the murmur. In the remaining 7 animals with a heart murmur, a specific

cause was not identified, and the murmur was considered physiologic. A physiologic murmur (innocent murmur or functional murmur) is defined as a heart murmur that is primarily due to physiologic conditions outside the heart, as opposed to structural defects in the heart itself. These findings lead us to suggest that the prevalence of physiologic heart murmurs in chinchillas is higher than in other species. In a similar study⁸ involving 103 cats, 22 (21%) had a heart murmur; echocardiography was performed in 7 of these cats, and results of echocardiography were considered normal in only 1. Importantly, because of likely selection bias (ie, chinchillas that underwent echocardiography likely had other signs that precipitated additional diagnostic testing and, thus, were probably more likely to have an abnormality than were chinchillas that did not undergo echocardiography) and the small number of chinchillas with heart murmurs that underwent echocardiography, results of the present study likely do not accurately reflect the prevalence of cardiac disease in all chinchillas with a heart murmur.

Degenerative valvular diseases were the most common echocardiographic abnormalities in the present study (5/8). Mitral valve regurgitation was found in 4 chinchillas, and tricuspid regurgitation was found in 1. Chronic mitral valve insufficiency secondary to myxomatous degeneration has been estimated to account for 75% to 80% of cardiac diseases in dogs.⁹ The prevalence of chronic mitral valve insufficiency is strongly age dependent, ranging from a few percent in young dogs to approximately 75% in dogs > 16 years old.⁹ Degenerative atrioventricular valve disease has been identified in chinchillas and other exotic mammals, including rabbits and ferrets.^{3,10,11} Chronic degenerative atrioventricular valve disease is more frequently identified in older

rabbits.¹¹ The mitral valve is the most commonly affected valve, but lesions may also involve the tricuspid valve.¹⁰ Acquired valvular disease is the second most common cardiac disease seen in ferrets.¹¹ The pathogenesis remains unknown, and the disease occurs in middle-aged to elderly ferrets.

In the present study, heart murmur grade was associated with the presence of an echocardiographic abnormality. In cats and dogs,⁷ physiologic murmurs can be caused by decreased blood viscosity or increased cardiac output, and physiologic murmurs are most often identified in animals with anemia, fever, or hyperthyroidism and in animals that are pregnant or have increased sympathetic tone. However, in young cats and dogs with heart murmurs, it is common to find no apparent cause.¹² Normally, these murmurs disappear within 4 to 5 months or during adolescence, but in some individuals, they may persist into adulthood.¹³ Physiologic murmurs are usually soft (grade 1 or 2 on a scale from 1 to 6) and loudest at the left heart base.⁷ In our study, 7 of the 15 chinchillas that had a heart murmur and underwent echocardiography did not have any identifiable cardiac diseases. Five of these chinchillas had a grade 3 murmur, and 2 had a grade 1 murmur.

There have been few clinical reports of cardiac disease in chinchillas, despite the fact that murmurs of various intensities are often found on routine examination of young chinchillas.^a In a study⁶ determining echocardiographic measurements in chinchillas, 3 of 20 chinchillas had a heart murmur. The 3 animals with murmurs were evaluated echocardiographically but not included in the data set. One had mitral valve insufficiency and an abnormal myocardial appearance. No specific changes were detected during Doppler-flow echocardiography in the remaining 2 animals with murmurs, and these murmurs were assumed to be physiologic. Dilated cardiomyopathy has been reported in 2 young black velvet female chinchillas.³ A ventricular septal defect and tricuspid regurgitation have also been reported in a single male 16-month-old chinchilla.⁵ That animal lacked apparent clinical signs at the time of diagnosis but died at approximately 2 years of age. Necropsy findings included papillary muscle dysplasia, mitral valve malformation, and a ventral septal defect.

Limitations of the present study include the number of clinicians who examined chinchillas included in the study and the number who performed echocardiography. However, we believe the impact of interoperator variability was low because all echocardiographers had advanced training. Other potential criticisms of the present study would include the low number of echocardiographic examinations performed (n = 15), compared with the number of animals included in the study (260) and the number of chinchillas with heart murmurs (60). Also, the lack of follow-up was a limitation because some an-

imals could have developed cardiac diseases with age. Inclusion of necropsy findings might have allowed us to identify cardiac diseases in chinchillas for which the owners declined echocardiography.

In conclusion, the prevalence of heart murmurs in chinchillas in the present study was high (23%), and murmur grade was associated with detection of echocardiographic abnormalities. These results suggested that cardiac abnormalities in chinchillas may be underdiagnosed and that echocardiography should be recommended for chinchillas with a heart murmur, particularly for chinchillas with a heart murmur of grade 3 or higher. Atrioventricular valvular disease (presumably degenerative) was the most common echocardiographic abnormality identified, but because of the small number of chinchillas with abnormalities, additional studies need to be performed to confirm this finding.

- a. Hoefler HL. Clinical management of the chinchilla and hedgehog (abstr), in *Proceedings*. 11th Annu Avian Exot Anim Med Symp 1996;87–91.

References

1. Quesenberry KE, Donnelly TM, Hillyer EV. Biology, husbandry and clinical techniques of guinea pigs and chinchillas. In: Quesenberry KE, Carpenter JW, eds. *Ferrets, rabbits, and rodents: clinical medicine and surgery*. 2nd ed. Philadelphia: WB Saunders Co, 2004;232–245.
2. Walker EP. *Mammals of the world*. Vol II. 3rd ed. Baltimore: Johns Hopkins University Press, 1975.
3. Ritchey L, Cogswell M. *The joy of chinchillas*. 3rd ed. Menlo Park, Calif: California Chinchilla Association, 1995;26–37.
4. Donnelly TM. Disease problems of the chinchillas. In: Quesenberry KE, Carpenter JW, eds. *Ferrets, rabbits, and rodents: clinical medicine and surgery*. Philadelphia: WB Saunders Co, 2004;255–265.
5. Hoefler HL, Crossley DA. Chinchillas. In: Meredith A, Redrobe S, eds. *BSAVA manual of exotic pets*. 4th ed. Quedgeley, Gloucester, England: British Small Animal Veterinary Association, 2002;65–75.
6. Linde A, Summerfield NJ, Johnston M, et al. Echocardiography in the chinchilla. *J Vet Intern Med* 2004;18:772–774.
7. Prosek R. Abnormal heart sounds and hearts murmurs. In: Ettinger SJ, Feldman EC, eds. *Textbook of veterinary internal medicine*. 6th ed. St Louis: Elsevier Saunders, 2005;195.
8. Côté E, Manning AM, Emerson D, et al. Assessment of the prevalence of heart murmurs in overtly healthy cats. *J Am Vet Med Assoc* 2004;225:384–388.
9. Häggström J, Kvart C, Pedersen HD. Acquired valvular heart disease. In: Ettinger SJ, Feldman EC, eds. *Textbook of veterinary internal medicine*. 6th ed. St Louis: Elsevier Saunders, 2005;1022.
10. Pariaut R. Cardiovascular physiology and diseases of the rabbit. *Vet Clin North Am Exot Anim Pract* 2009;12:135–144.
11. Wagner RA. Ferret cardiology. *Vet Clin North Am Exot Anim Pract* 2009;12:115–134.
12. Harpster NK. Cardiovascular diseases. In: Holzworth J, ed. *Diseases of the cat: medicine and surgery*. Philadelphia: WB Saunders Co, 1987;820–933.
13. Bonagura JD. Cardiovascular diseases. In: Sherding RG, ed. *The cat: diseases and clinical management*. 2nd ed. St Louis: Churchill Livingstone Inc, 1994;824.