Published in final edited form as:

J Vet Intern Med. 2011 March ; 25(2): 405–406. doi:10.1111/j.1939-1676.2011.0689.x.

Evaluation of the 6 minute walk test (6MWT) in pet dogs

Rebecca A. Swimmer, AM and Elizabeth A. Rozanski, DVM, DACVECC, DACVIM

Section of Critical Care, Department of Clinical Sciences, Tufts Cummings School of Veterinary Medicine, 200 Westboro Rd., North Grafton, MA 01536

Abstract

Background—The 6-minute walk test (6MWT) is widely used in human medicine to objectively assess the degree of impairment, and to provide objective evidence of disease progression or response to therapy.

Hypothesis/Objectives—The 6MWT will be easy to perform and well-tolerated in pet dogs. Dogs with pulmonary disease will walk shorter distances than healthy dogs.

Animals—69 healthy dogs were recruited from the hospital community. Six dogs with mild to moderate pulmonary disease were recruited from animals presented for evaluation at the teaching hospital.

Methods—Prospective study. Dogs walked for 6 minutes in a hallway and the distance covered was measured. Pulse oximetry and heart rate were recorded before and after walking. Physical characteristics of the dogs, including age, leg length, body condition score and weight were recorded. Healthy dogs were compared with affected dogs using a Student's *t* test ($P < 0.05$). Correlations were calculated between the age, physical characteristics and distances walked in the healthy dogs.

Results—Healthy dogs walked 522.7 ± 52.4 meters, while sick dogs ($n=6$) walked 384.8 ± 41.0 meters ($P < 0.001$). There was low ($r=0.13$) to moderate ($r=0.27$) correlation in the healthy dogs between physical characteristics and distances walked.

Conclusions and clinical importance—The 6MWT was easy to perform and discriminated between healthy dogs and dogs with pulmonary disease.

Keywords

pulmonary; pulmonary function testing; exercise intolerance

Pulmonary dysfunction is common in companion animals. In animals with mild to moderate impairment it can be difficult to determine the actual degree of dysfunction. Pulmonary function testing is used to provide an objective assessment of lung function. Common methods of evaluating pulmonary function in dogs include measurement of arterial blood gas tensions, tidal breathing flow-volume loops, measurement of compliance and airway resistance. The 6-minute walk test (6MWT) is used in people as a functional assessment of the cardiopulmonary reserves. It is not designed to evaluate maximal effort, but instead to more closely evaluate the activities of daily living. This test is performed by measuring the distance an individual can walk comfortably in six minutes.¹ The 6-Minute Walk Test (6MWT) is used in human medicine as a predictor of morbidity and death from heart or lung disease as well as a method of assessing an objective response to therapeutic interventions.

^{2–8} The 6MWT has also been used in children, and a recent study validated normal ranges in children 4–11 years of age.⁹

To date, there has been only one published work using the 6MWT in veterinary medicine. This study used a research population of large hound dogs with congestive heart failure induced by rapid ventricular pacing. The results showed a significant decrease in the distance walked from 573 ± 85.5 m to 526 ± 99.4 m as heart failure developed.¹⁰

Due to its simplicity, validation of the 6MWT would represent a major addition to the armamentarium of clinical veterinary pulmonary function testing for pet dogs. The objectives of this study were to 1) To determine the distance walked in 6 minutes (6MWT) in healthy dogs 2) To determine the change in oxygen saturation (SpO_2) and heart rate in these same dogs and 3) To conduct a pilot study to evaluate the 6MWT as a method of objectively assessing pulmonary function in dogs with respiratory disease.

Materials and Methods

Healthy dogs

Dogs were recruited from the community. Dogs were eligible if they were 6 months of age or older, and had no pre-existing conditions that were considered to influence the dog's performance on the 6MWT.

Affected dogs

Dogs with evidence of mild to moderate pulmonary disease were recruited from the clinical services at a veterinary teaching hospital. Dogs were excluded if they were being treated with supplemental oxygen, or if they had concurrent orthopedic or neurological disease that could the test results.

Signalment data, body condition score (Purina scale 1–9) and leg length in centimeters were recorded from all dogs. Oxygen saturation (SPO_2) and heart rate were recorded. Dogs were next walked in a hallway (15.24 meters [50ft] in length) for a period of 6 minutes. Dogs were allowed to set their own pace, and were allowed to rest if they desired. The distance walked was recorded in meters. Pulse oximetry and HR were recorded immediately following the 6 minute walk. The study was approved by the Clinical Studies Review Committee and owner's provided informed consent.

Statistics

Descriptive statistics were calculated. A t-test was used to compare distance walked, HR, BCS and SPO_2 in healthy dogs and affected dogs, and a paired t-test was used to compare values before and after walking for SPO_2 and HR in healthy and affected dogs. In healthy dogs, correlation between age, leg length, weight, BCS and distance walked were calculated using the Pearson product-moment correlation coefficient. The incidence of desaturation ($SpO_2 < 94\%$) was recorded.

Results

All dogs tolerated the study well, and no complications were observed. Healthy dogs walked 522.7 ± 52.4 meters (Table 1). Six dogs affected with pulmonary disease walked a significantly shorter distance at 384.8 ± 41 meters ($P < 0.001$). Affected dogs had chronic bronchitis (3), pulmonary fibrosis (2), and pulmonary hypertension (1) Significant differences were found between the healthy and affected groups for total distance walked, pre-walk SpO_2 (pre SpO_2), post-walk SpO_2 (post SpO_2), leg length, weight, age and post-

walk (post HR). No significant differences in pre-walk HR (pre HR) or BCS were found between healthy and affected dogs. There were weak or moderate correlations between age ($r=0.1$, $p=0.4$), leg length ($r=0.27$, $p=0.02$), and weight ($r=0.13$, $p=0.14$) and distance walked. There was no correlation with BCS ($r=0.08$, $p=0.51$) and distance walked in healthy dogs. There was a strong correlation ($r=0.98$, $p<0.001$) between leg length and weight in healthy dogs. The incidence of desaturation was 1/69 (1.4%) of the healthy dogs and 6/7 (86%) in the affected dogs.

Discussion

This study demonstrated the potential utility of the 6MWT in dogs. Healthy dogs walked farther and with less desaturation than did dogs with pulmonary disease. The test was simple and well-tolerated and serves as a useful baseline value for further clinical evaluation. Mild to moderate pulmonary dysfunction is difficult to objectively identify and assess using traditional methods such as radiography, computed tomography, arterial blood gas analysis, bronchoscopy, sampling of pulmonary secretions and pulmonary function testing. This study was undertaken to standardize the 6MWT in a mixed population of healthy dogs and to perform a pilot study to evaluate the use of the 6MWT in dogs with mild to moderate pulmonary dysfunction.

This work in healthy pet dogs had very similar results to that previously reported in healthy research hounds that walked a mean of 573 ± 85.5 m.¹⁰ This study, which included a wide variety of breeds, ages and sizes of healthy dogs is more likely relevant to the standard veterinary population at large, which encompasses many breeds of dog. Interestingly, these data are also similar to that found in healthy children, who walked 470 ± 59 m, and in healthy adult men (580 m) and healthy women (500 m).

While affected dogs were significantly smaller and older than healthy dogs, there was only moderate correlation in healthy dogs between size and distance walked. This finding most likely reflects the higher incidence of pulmonary disease in older small breed dogs.

The ultimate role for the 6MWT in dogs remains to be determined. In dogs with pulmonary compromise at rest, there is might be no specific additional information gained. However, in dogs with minimal clinical signs, the 6MWT might serve as an additional method of screening for subtle dysfunction, as well as for objectively evaluating response to therapy or progression of disease.

In conclusion, the 6MWT appears to be a simple and effective method of screening for exercise tolerance. Quality of life, in dogs as well as people, is a significant concern to the medical profession, and the ability to perform standard activities of daily living features prominently into quality of life studies.

Acknowledgments

Support provided by the Short Term Training Grant in Health Professional Schools, supported by NIH T35 DK07635.

Abbreviations

6MWT	6 minute walk test
SPO2	oxygen saturation

References

1. Enright PL. The Six-Minute Walk Test. *Respir Care* 2003;48:783–785. [PubMed: 12890299]
2. Olsson LG, Swedberg K, Clark AL, et al. Six minute corridor walk test as an outcome measure for the assessment of treatment in randomized, blinded intervention trials of chronic heart failure: a systemic review. *Eur Heart J* 2005;26:778–793. [PubMed: 15774495]
3. Brown CD, Wise RA. Field tests of exercise in COPD: the six-minute walk test and the shuttle walk test. *COPD* 2007;4:217–223. [PubMed: 17729065]
4. Lee AL, Button BM, Ellis S, et al. Clinical determinants of the 6-Minute Walk Test in Bronchiectasis. *Respir Med* 2008;1–6. [PubMed: 17954027]
5. Caminati A, Bianchi A, Cassandro R, et al. Walking distance on 6-MWT is a prognostic factor in idiopathic pulmonary fibrosis. *Respir Med* 2009;103:117–123. [PubMed: 18786822]
6. Villalba WO, Sampaio-Barros PD, Pereira MC, et al. Six-minute walk test for the evaluation of pulmonary disease severity in scleroderma patients. *Chest* 2007;131:217–222. [PubMed: 17218579]
7. Hoffman AM. Airway physiology and clinical function testing. *Vet Clin North Am Small Anim Pract* 2007;37:829–843. [PubMed: 17693201]
8. Garcia-Talavera I, Garcia CH, Macario CC, et al. Time to desaturation in the 6-min walking distance predicts 24-hour oximetry in COPD patients with a PO₂ between 60 and 70 mmHg. *Respir Med* 2008;102:1026–1032. [PubMed: 18343649]
9. Lammers AE, Hislop AA, Flynn Y, et al. The 6-minute walk test: normal values for children 4–11 years of age. *Arch Dis Child* 2008;93:455–456. [PubMed: 18495907]
10. Boddy KN, Roche BM, Schwartz DS, et al. Evaluation of the six-minute walk test in dogs. *Am J Vet Res* 2004;65:311–313. [PubMed: 15027678]

Table 1

6MWT comparison between 69 healthy dogs and 6 affected dogs. BCS- Body condition score, SPO2- oxygen saturation as assessed by pulse oximetry.

Characteristic	Healthy	Affected	P-value
Age (years)	5.1 ± 4.5	10.8±2.3	<0.001
Weight (kg)	22.9 ± 11.2	11.9 ±8.2	0.01
BCS	5.6 ± 0.8	6 ± 0.5	0.13
Leg length (cm)	26.5 ± 7.1	18.3 ± 6.2	0.01
Distance walked (m)	522.7± 52.4	384.8 ± 4.0	<0.001
Pre SpO2 (%)	98± 1	92± 3	<0.001
Post SpO2 (%)	97 ± 1.5	91± 3	<0.001
Pre HR (bpm)	112 ± 25	129 ± 28	0.13
Post HR (bpm)	112± 20	132 ± 23	0.02