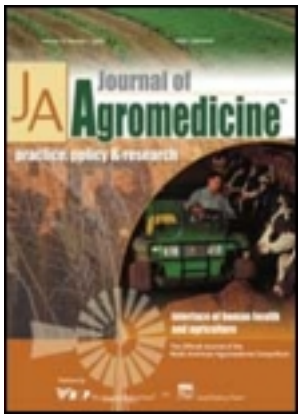

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Bronchodilator Responsiveness in Swine Veterinarians

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ABSTRACT. *Objective:* Swine veterinarians are known to be at risk for respiratory symptoms and airflow obstruction. The present study reassessed the prevalence of respiratory complaints and pulmonary function abnormalities in swine veterinarians and sought to characterize their response to bronchodilators.

Methods: A cross-sectional study was conducted during the American Association of Swine Veterinarians annual meeting. Subjects completed a respiratory symptom and workplace exposure history questionnaire and spirometry. Subjects with airflow obstruction were assessed for a post-bronchodilator response with beta$_2$ agonist administration.

Results: Participants included 58 veterinarians (mean age, 45.5 years). Work-related symptoms

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assessed by questionnaire included rhinitis symptoms (60.3%), cough and chest tightness (55.2%), and wheezing (35.1%). Airflow obstruction was detected in 11/58 (19%) of subjects by spirometry. Only 2/9 (22.2%) met American Thoracic Society criteria for reversibility with bronchodilator administration.

Conclusions: Respiratory symptoms and airway obstruction remain common findings in swine veterinarians. Airflow obstruction was not consistently reversible with beta agonists, suggesting that swine barn exposure may be a risk factor for irreversible airflow obstruction. doi:10.1300/J096v12n02_06

KEYWORDS. Airflow obstruction, bronchodilator, swine, veterinarian, wheezing

INTRODUCTION

There are many occupational hazards associated with the practice of swine veterinarians, including adverse respiratory effects related to their work in swine confinement buildings.[1-5] Respiratory symptoms in employees working in swine confinement facilities were first documented by Donham and colleagues in 1977.[6] Subsequent investigations confirmed the high prevalence of adverse respiratory effects in subjects exposed to swine confinement barns, and demonstrated that many of the individuals have airflow obstruction.[7-16] There are a number of environmental factors that have been implicated in causing these harmful effects, and include dust, endotoxin, Gram negative and Gram positive bacteria, molds, ammonia, hydrogen sulfide, and quaternary ammonium compounds.[7,10,12] Although the frequency and duration of exposure to swine confinement barns may be greater in farmers and swine confinement unit employees, swine veterinarians can also be exposed to this environment, risking airway disorders.

Despite improvements in barn ventilation over time, we recently reported that 25% of swine veterinarians demonstrated airflow obstruction that was associated with hours per week spent in swine barns and independent of smoking history.[1] Whether the airflow obstruction observed is irreversible as is typically seen in chronic obstructive pulmonary disease or reversible as in asthma is not clear.[16] Thus, assessing response to bronchodilators has important implications in guiding medical management options and treatment. The objective of the present study was to reassess the prevalence of respiratory complaints, lung function abnormalities, and determine response to bronchodilators in large animal practitioners currently working as swine veterinarians.

METHODS

The design of the study was a convenience sample of swine veterinarians attending the American Association of Swine Veterinarians meeting in Des Moines, Iowa (2004). The population was recruited from 807 registrants via advertisement in their registration packet and a general session announcement. All registrants were invited to participate. Inclusion criteria were as follows: Persons aged 21 years or older and currently practicing veterinary medicine with greater than one year of swine barn exposure. The University of Nebraska Medical Center Institutional Review Board approved this study. Written informed consent was obtained from all subjects.

A self-administered questionnaire, previously used with swine veterinarians,[1] was completed by each participant. Information was obtained on the following: demographics, respiratory symptoms assessed by using questions from the American Thoracic Society Epidemiology Standardization Project,[17] smoking history (never, past, current), veterinary practice exposures, and farming history (never, past, current). Veterinary exposures were assessed by asking questions regarding type of practice (swine only, mixed large animal, university or industry), hours per week in hog barns, years of working in hog barns and the use of respiratory protective devices during work.

Pulmonary function tests were performed in triplicate using the Puritan Bennett Renaissance II spirometer (Puritan Bennett; Wilmington, MA) according to American Thoracic Society standards.[18] Forced vital capacity (FVC/L), forced expiratory volume (FEV_1/L), and forced expiratory flow during the middle half of the forced vital capacity ($FEF_{25\%-75\%}$) were calculated using the equations of Knudson et al.[19] Airflow obstruction was defined as FEV_1/FVC ratio less than 70% and/or FEV_1 less than 80% of predicted.[20-21] To assess bronchodilator response, subjects with airflow obstruction were given 2 inhalations of albuterol administered through an aerochamber and spirometry was repeated 15 minutes later. A positive bronchodilator response was defined by a greater than or equal to 12% and 200 mL increase in FEV_1 calculated from the prebronchodilator value.[18]

Data were analyzed using SAS software (SAS Version 9.1, SAS Institute; Cary, NC). Comparisons between subjects with obstruction and without obstruction were made using Exact Wilcoxon two-sample tests with Monte Carlo estimation.

RESULTS

Sixty-eight persons volunteered to participate in the study. Nine subjects were excluded because they were not currently practicing swine veterinarian medicine, or did not work at least one year in a swine barn. One subject refused spirometry and was excluded from the analysis. The American Association of Swine Veterinarians does not collect demographic data; therefore, we were unable to determine if these subjects were representative of the membership. The mean age of the subjects was 45.5 years (range, 25-72). The majority of the subjects were from the United States (n = 44), with the remainder from Canada (n = 8), Cyprus (n = 1), Denmark (n = 1), Switzerland (n = 1), Spain (n = 1), Mexico (n = 1), and Uruguay (n = 1). The vast majority of the subjects were men (86.2%). Of note, only nine of the subjects reported ever smoking, and only one subject was a current smoker. Of the group, 60.3% reported using respirators in the barns, but only 8.6% wore the respirator at all times. Work-related symptoms were common (82.8%) and included rhinitis symptoms (60.3%), cough and chest tightness (55.2%), and wheezing (35.1%).

Eleven subjects (19%) demonstrated airflow obstruction by spirometry. The descriptive characteristics and respiratory parameters of subjects with (n = 11) and without (n = 47) airflow obstruction are shown in Table 1. There were no differences between subjects with and without airflow obstruction in regards to self-reported symptoms of cough or chest-tightness, sneeze, or loss of smell with swine barn exposure. Subjects with obstruction reported more wheeze with exposure to swine barns than subjects without obstruction ($p = 0.038$). In subjects with obstruction, there was a trend toward general large-animal veterinary practice versus swine only, university, or industry practice when compared to subjects without obstruction (60% versus 26.2%). Of the total population, 81.5% were current or past farmers, and all swine veterinarians with airflow obstruction were either current or past farmers. Swine veterinarians with airflow obstruction had a mean FEV_1/FVC of 66.0% ± 1.7 SE, FEV_1% predicted of 85.5% ± 5.3 SE, and FEF_{25-75}% predicted of 51.3% ± 4.7 SE.

Table 2 shows the post-bronchodilator response of the nine subjects with airflow obstruction (two subjects refused). The mean age of subjects with obstruction was 47.5 years. Eight had mild obstruction, and one had moderate obstruction. Only two of the subjects with airflow obstruction met the American Thoracic Society criteria for a positive response to bronchodilator.[18] None of the subjects with airflow obstruction were current smokers, and only one of the subjects (#9) had ever smoked (48 pack year smoking history, quit two years prior). The mean number of years of swine barn exposure was 24.5 years.

DISCUSSION

Our results show that a persistently high prevalence of respiratory symptoms and airflow obstruction exists in large animal practitioners working as swine veterinarians. The airflow obstruction observed was mild and did not significantly reverse with albuterol. The most commonly reported respiratory symptoms ob-

TABLE 1. Characteristics of swine veterinarians with and without airflow obstruction.[a]

	Obstructed (n=11)	Non-obstructed (n=47)	p value
Age, mean yr (SD)	47.5 (10.0)	44.7 (11.7)	0.5
Sex, Male, No (%)	10 (90.9)	40 (85.1)	1.0
Smoking History, No (%)			1.0
Never	9 (90)	39 (83.0)	
Past	1 (10)	7 (14.9)	
Current	0	1 (2.1)	
Veterinary Practice, No (%)[b]			0.0065
Swine Only	1 (10.0)	19 (45.2)	
Large Animal	6 (60.0)	11 (26.2)	
University & Industry	3 (30.0)	12 (28.6)	
Respirator Use, No (%)[b]			0.28
Never	4 (40.0)	18 (38.3)	
Sometimes	4 (40.0)	26 (55.3)	
Always	2 (20.0)	3 (6.4)	
Swine Barn Exposure			
Hours/week, mean (SE)	12.4 (3.7)	15.4 (2.0)	0.51
Years, mean (SE)	24.5 (4.5)	22.6 (2.0)	0.68
Farming History, No (%)[b]			0.08
Never	0	10 (22.7)	
Past	4 (40.0)	21 (47.7)	
Current	6 (60.0)	13 (27.7)	
Chronic Bronchitis, No (%)[b, c]	2 (20)	3 (7.1)	0.24
Doctor-diagnosed Asthma, No. (%)	3 (27.3)	7 (14.9)	0.38
Symptoms with swine barn exposure, No. (%)			
Cough or chest-tightness	8 (72.7)	24 (51.1)	0.3
Sneeze	7 (63.6)	28 (59.6)	1.0
Wheeze[b]	7 (63.6)	13 (28.3)	0.038
Loss of smell	5 (45.5)	12 (25.5)	0.27
FEV_1 % predicted, mean (SE)	85.5 (5.3)	102.4 (1.8)	<0.0001
FVC % predicted, mean (SE)	105.6 (6.1)	105.4 (2.0)	1.0
FEV_1/FVC, mean (SE)	66.0 (1.7)	79.9 (0.7)	<0.0001
FEF_{25-75} % predicted, mean (SE)	51.3 (4.7)	95.1 (3.3)	<0.0001

[a] Airway obstruction defined as FEV_1/FVC < 70% or FEV_1< 80%.[19-20]
[b]Total number of subjects not equal to 58 due to missing data
[c]Chronic bronchitis was defined as self-reported cough and phlegm on most days for 3 or more consecutive months during the year.

served included rhinitis, cough, chest tightness, and wheeze. This observation is consistent with the findings of other investigations.[1,3] However, it has not been clear if the symptoms and/or airflow obstruction observed in this population are reversible after $beta_2$ agonist administration as is seen in asthma or irreversible as seen in chronic obstructive pulmonary disease.

In this study, we found that the majority (77.8%) of the subjects with airflow obstruction did not demonstrate significant reversibility after bronchodilator administration according to the American Thoracic Society guidelines.[18] This suggests that the occupational exposure to large animal confinement facilities may result in a fixed, irreversible airflow obstruction, rather than reversible airflow obstruction. One limitation to characterizing the airflow obstruction as fixed is that subjects were not given a trial of corticosteroids, which might have resulted in reversal of the airflow obstruction. However, inhalation of corticosteroids given prior to swine confinement facility exposure has been shown to exert no influence on

TABLE 2. Demographics and lung function of the swine veterinarians with airflow obstruction.[a,b]

No	Sex	Age (yrs)	Swine Barn Exposure (total yrs)	FVC, L (% pred)	FEV_1/FVC	Pre-FEV_1, L (% pred)	Post-FEV_1, L (% pred)	FEV_1 (% change)
1	F	42	4	3.53 (105)	54	1.92 (68)	3.08(110)	60
2	M	40	28	5.64 (103)	65	3.69 (82)	4.01 (89)	8
3	M	25	13	6.65 (109)	67	4.45 (87)	4.53 (89)	1
4	M	47	20	6.03 (94)	67	4.02 (78)	4.22 (82)	5
5	M	44	33	5.64 (110)	69	3.91 (93)	4.19 (100)	7
6	M	48	40	4.41 (88)	73	3.22 (79)	3.68 (90)	14
7	M	52	15	4.81 (90)	66	3.19 (74)	3.54 (82)	10
8	M	61	4	6.41 (121)	63	4.03 (95)	4.18 (99)	4
9	M	53	35	5.2 (102)	60	3.14 (76)	3.52 (85)	11

[a]Airway obstruction defined as FEV_1/FVC < 70% or FEV_1< 80%.[19-20]
[b]Two subjects with airflow obstruction refused bronchodilator evaluation.

bronchial responsiveness to methacholine.[22] Our observation of failure to adequately respond to $beta_2$ agonists has significant clinical implications because $beta_2$-agonist monotherapy may not be adequate treatment. In addition, it may not be warranted to classify these subjects as asthmatics, but more informative to classify these subjects as having chronic obstructive pulmonary disease.

It is noted that this study was a small, non-random sample, which may represent a biased population of swine veterinarians with airway disease who volunteered to enroll, and thus overestimating the true prevalence of airflow obstruction. However, an exposure challenge (pre- and post-challenge to a swine confinement facility) was not conducted, which may have elicited more obstructive findings then found in this study's setting. This highlights the importance that airflow obstruction does occur in this population, and may persist after animal exposure is removed. It is also not clear if the convenience sample in this study was proportional to those attending the meeting and/or representative of swine veterinarians in general. Ideally, the American Association of Swine Veterinarians would begin collecting this information, and this would allow recruiting of a representative population for future studies. Finally, further characterization studies of the type of airflow obstruction in this population are necessary in order to tailor appropriate medical management. This would include determination of corticosteroid responsiveness, bronchial-hyperreactivity to methacholine, and pre- and post-exposure challenge assessments.

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