

Research Article

Postambulatory Hand Swelling (Big Hand Syndrome): Prevalence, Demographics, and Association with Dog Walking

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Introduction. Postambulatory hand swelling (PAHS) seems to be common in the general population. There are few mentions in the medical literature. The objectives were (1) to identify prevalence; (2) to compare gender and age groups; (3) to determine if dog owners and walkers are more or less prone. **Materials and Methods.** 1009 semirandomly surveys were completed from walkers. Age, gender, and dog ownership were assessed. We discussed, among dog owners, whether or not they walk their dog regularly, whether or not they notice swollen hands after walking, and, if so, if the swelling resolves over 24 hours or persists. **Results.** 699 females and 410 males, among whom, 28.9% of females but only 16.3% of males reported PAHS ($P < 0.001$). Surprisingly, those with swelling were statistically younger than those without (49.2 versus 52.8 years, $P = 0.003$), and dog owners were more likely than nonowners to report swelling (28.1% versus 21.7%; $P = 0.015$). In terms of persistent swelling, this was observed in twice the percentage of females as males (13.3 versus 6.5%) and tended to involve older subjects (54.0 versus 48.8 years), but with no statistical difference significance. **Conclusions.** PAHS is a relatively common phenomenon, seemingly more common in females.

1. Introduction

In the scientific literature, numerous causes of isolated, unilateral or bilateral, generalized hand swelling are described. These include carpal tunnel syndrome [1, 2], thoracic outlet syndrome [3], reflex sympathetic dystrophy [4], Raynaud's phenomenon and disease [5], scleroderma [6], tumors, radiation, surgery, and trauma [7, 8], among others. Among intravenous drug addicts, the term "puffy hand syndrome" has been coined [9, 10]. However, none of these underlying conditions seems to explain the idiopathic generalized hand swelling that seems to be a common occurrence in the general clinic population, and which can be debilitating, at least in some.

For this study, we had a few simple objectives: (1) to identify how common generalized post-ambulatory hand swelling—so-called "big hand syndrome"—is in a population of individuals partaking of a once monthly walking program via local parks; (2) to compare males and females, and different age groups, as to the prevalence of big hand syndrome; (3)

to determine if dog walkers are more prone to this condition than nondog walkers. One rationale for the third objective was to determine if the activity of walking while holding a leash is more or less likely to cause post-ambulatory swelling of the hand.

2. Materials and Methods

Prior to subject recruitment, the study protocol was approved by the ethics board of the Institute of Orthopaedics and Health of São Paulo. As part of a prospective, semirandom study, individuals participating in a 3-site community park walking exercise program were asked to participate in a brief point-in-time, in-person survey. Each month, the *Institute of Orthopaedics and Health of São Paulo*, a nonprofit organization that aims to educate the general public regarding health maintenance and disease prevention, sponsors a radio program and one-day walking event in local parks throughout the greater

metropolitan area of São Paulo. Recruitment for the study was done through the walking event program, via radio announcements, in-person park interviews, and recruitment at three participating clinics. All interviews were undertaken in Portuguese, the national language of Brazil. The only requirements for eligibility were (1) age >10 years old; (2) participation in the one-day walking event; (3) able to understand and speak Portuguese to a level deemed adequate to participate in the survey, or have a competent translator available; and (4) willing to provide informed, written consent.

The primary objective of the overall study was to assess the prevalence of dog ownership and regular dog walking in Sao Paulo; the current investigation into post-ambulatory hand swelling grew out of our pilot investigations into this program, at which time several subjects reported this phenomenon. Consequently, after providing informed written consent, study participants were asked to identify (1) their age and gender; (2) if they owned a dog, and whether they walked their dog(s) regularly; (3) whether they had noticed any swelling of both hands after walking; if so, whether or not that swelling went away or persisted for more than 24 hours. The swelling was by references of difficulty to make a fist remove rings and watch or wristband. Prior to the study, the survey instrument had been reviewed by the walking event staff group and by three physicians at the *Institute of Orthopedics and Health*, and was deemed appropriate; then it was tested in two prior, monthly one-day walking events.

3. Statistical Analysis

The primary outcome of the current investigation was the proportion of individuals reporting swelling of either one or both hands. As a first step, this was estimated with 95% confidence intervals, as were the percentage of males and females with hand swelling. For bivariate inferential analysis, those with swelling and those without were compared in terms of mean age, age group, gender distribution, and the proportion of dog owners and dog walkers, with Student's *t*-test for unpaired samples to analyze continuous means and Pearson χ^2 analysis for ordinal and categorical variables. Males and females also were compared, as were those with persistent versus transient swelling, again using Student's *t*-tests and Pearson χ^2 analysis, as appropriate, except for analysis of categorical variables when there were fewer than 5 subjects per cell, at which time Fisher's exact test was used. Odds ratios with 95% confidence limits were calculated to compare males and females, dog owners and non-owners, and dog walkers and non-walkers. For multivariate analysis, a logistic regression model was created and tested with the presence or absence of swelling designated the dependent variable, and age, gender, dog ownership, and whether or not the person walked regularly as independent; with logistic analysis performed by (1) enter, (2) forward conditional, and (3) backward conditional selection methods. All tests were two tailed, and $P = 0.05$ was set as the threshold for statistical significance.

TABLE 1: Demographics of the total sample.

Total $N =$	1009
# (%) female	699 (63.0%)
# (%) male	410 (37.0%)
Mean age (years)	51.9
Age range (years)	11–92
Mean age—females	54.6*
Mean age—males	47.2*

TABLE 2: A comparison of subjects with and without post-ambulatory hand swelling.

	Swelling	No swelling
N (%) =	269 (24.3%)	840 (75.7%)
# (%) females	202 (28.9%)*	497 (71.1%)
# (%) males	67 (16.3%)*	273 (83.7%)
mean age (years)	49.2**	52.8**
# (%) among dog owners	124 (28.1%***)	317 (71.9%)
# (%) among nonowners	145 (21.7%***)	523 (78.3%)
# (%) dog walkers	51 (26.0%)	145 (74.0%)
# (%) dog nonwalkers	73 (29.8%)	172 (70.2%)

* $P < 0.001$, ** $P = 0.003$, *** $P = 0.015$.

4. Results

Out of the original sample of 1118 subjects, four were deemed ineligible for further analysis because of missing age data, and five because of missing data on the primary outcome—hand swelling—leaving 1009 subjects for final analysis (Table 1). Of these 1009, 699 were female (63.0%) and 410 male (37.0%). The age distribution of the survey sample was 2.7% under 20 years old; 27.6% 20–39 years old; 32.5% 40–59; 29.8% 60–79; 7.4% 80 or older. Males were statistically younger than females (47.2 versus 54.6 years, resp.; $P < 0.001$).

Two hundred sixty-nine subjects (24.1%, 95% confidence interval (CI) = 21.7, 26.8%) reported either unilateral or bilateral hand swelling that they noted after the walking they did as part of their walking exercise program (Table 2). Among females, 28.9% (95%CI = 25.5, 32.3%) reported hand swelling, versus just 16.3% (12.8, 19.9%) of males, a difference that was highly statistically significant ($P < 0.001$; Table 2 and Figure 1). The odds ratio (OR) for a female reporting swelling, relative to a male, was 2.08 (95%CI = 1.53, 2.83). The mean age among those with swelling was an average of roughly 3.5 years younger than those without swelling (49.2 versus 52.8 years; $P = 0.003$; Table 2); a statistically significant difference between those with and without hand swelling also was noted when age was treated as an ordinal variable (subdivided into 20-year age groups; $P = 0.001$; Figure 1). Additionally, a statistically significant difference was noted in the percentage of those with versus without hand swelling who were dog owners (46.1 versus 37.7%; $P = 0.015$; OR = 1.41; 1.07, 1.86), but not in the percentage who were regular versus irregular or non-walkers

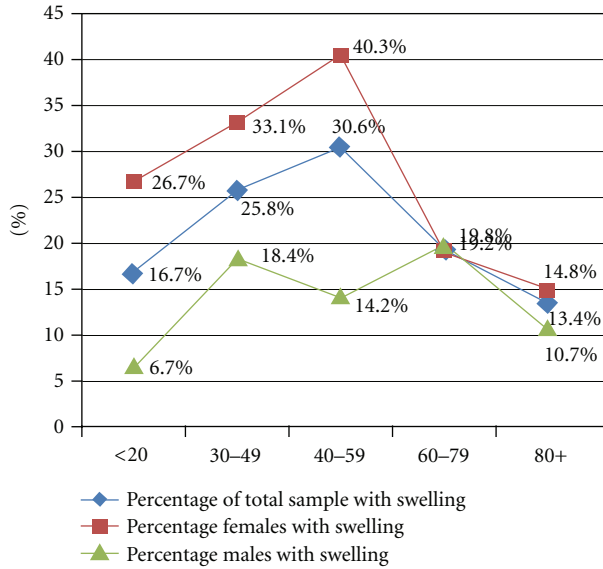


FIGURE 1: Subjects with post-ambulatory hand swelling versus no hand swelling, by age group and gender.

of their dogs (26.0 versus 29.8%, NS; OR = 0.83; 0.54, 1.26; Table 2).

Of the 269 who reported hand swelling, there were missing data on 11 for persistent swelling; of the remaining 258, 228 (88.4%) claimed that the swelling resolved within an hour or two after finishing their walk, and 30 (11.6%; 7.7, 15.5%) reported persistent swelling (Table 3). More than double the percentage of females than males reported persistent swelling (13.3 versus 6.5%, resp.); but, due to small numbers, this difference failed to achieve statistical significance ($P = 0.18$ by Fisher’s exact test). Those with persistent swelling averaged more than 5 years older than those without (54.0 versus 48.8 years); but again, this difference failed to achieve statistical significance ($P = 0.10$).

Upon logistic regression using three distinct variable selection methods (entry, forward conditional, and backward conditional), two variables remained in each of the three final models: gender and age (in each model, at $P = 0.001$ or less), being female and of younger age increasing the likelihood of reported swelling (Table 4). Among dog owners, walking one’s dog was associated with a decreased likelihood of hand swelling in two of the three models (both at $P = 0.019$).

5. Discussion

As stated at the outset, there is a surprising dearth of literature documenting or attempting to explain the relatively common phenomenon of generalized idiopathic hand swelling, and none describing post-ambulatory hand swelling. In our sample of 1009 individuals, ranging in age from 11 to 92 years, almost one in four (24.3%) individuals reported post-ambulatory hand swelling, and the odds of a female reporting swelling were twice that of a male. This distinction, between females and males, only was apparent in subjects younger than 60 years old; after this, the two

TABLE 3: A comparison of subjects with persistent versus transient post-ambulatory hand swelling.

	Permanent	Transient
<i>N</i> (%) =	30 (11.6%)	228 (88.4%)
# (%) females	26 (13.3%)	170 (86.7%)
# (%) males	4 (6.5%)	58 (93.5%)
mean age (years)	54	48.8
# (%) dog owners	13 (11.1%)	104 (88.9%)
# (%) dog walkers	23 (71.9%)*	164 (71.9%)

* data available for 32 subjects.

TABLE 4: Results of logistic regression analysis.

Selection method	Variable in the model	<i>B</i> =	Statistical significance
Enter	Gender	0.858	$P < 0.001$
	Age	-0.014	$P = 0.001$
Forward conditional	Gender	0.848	$P < 0.001$
	Age	-0.014	$P < 0.001$
	Walking the dog	0.380	$P = 0.019$
Backward conditional	Gender	0.848	$P < 0.001$
	Age	-0.014	$P < 0.001$
	Walking the dog	0.380	$P = 0.019$

sexes exhibited an almost identical prevalence of hand swelling. Surprisingly, those who reported swelling averaged 3.5 years younger than their counterparts, a difference that was statistical-ly significant. This finding certainly seems counter-intuitive, given that dependent swelling generally increases with age. On the other hand, those with persistent swelling beyond 24 hours after walking cessation tended to be slightly older.

Another surprising finding was that dog owners were more likely to report swelling than non-owners, but this variable disappeared upon multivariate analysis, suggesting some interaction with either subject gender or age. Dog owners who claimed to walk their dogs regularly were less likely to report swelling than those who stated otherwise, which argues for regular walking reducing the prevalence of this phenomenon. This being said, we can only speculate as to the mechanisms behind this hand swelling. In other settings, hand swelling has been attributed to reduced venous return from the hand, as in carpal tunnel syndrome, thoracic outlet syndrome, scleroderma, and Raynaud’s disease [1–3, 5–8, 10–12]; also to presumed autonomic dysfunction [4, 7, 8]. In intravenous drug abusers, both mechanisms may be at play, the former because of venous damage due to repeated self-venipuncture, and both mechanisms potentially related to the drugs themselves [9]. Unexplained hand swelling has been reported in one patient immediately following acupuncture treatment [12], presumably related to some systemic neurogenic effect. The one theory for hand swelling after ambulation that has been proposed was by Collins et al., who suggested that improper arm motion, forcing

excess fluid into the hands by “centrifugal force,” or alternatively, exercise-altered metabolic rates might be responsible [11].

Our results clearly should not be considered definitive. To begin with, our sample was neither randomly selected (subjects essentially selected themselves) or representative of the general population (again, because subjects all had chosen to participate in a specific walking program). We limited our data collection to just two demographic variables (age and gender) and a couple of additional variables related to dog ownership. We made no attempts to verify hand swelling by examination; we made no attempt to delve into other potential mechanisms behind the hand swelling, like associated diseases and medications. All we can say is that all our subjects were healthy enough to enroll themselves in a community walking event.

Nonetheless, our findings, and the fact that this issue is virtually totally ignored by the scientific literature, certainly are food for thought, and seem to justify further study into this relatively common and yet completely unexplained phenomenon.

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