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Prevalence, impact and specialised treatment of urinary incontinence in women with chronic lung disease

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Abstract

Objectives To determine in women with clinically stable chronic lung disease (CLD) and healthy women; (1) prevalence of urinary incontinence; (2) risk factors for urinary incontinence; (3) effects of a standard course of specialised physiotherapy treatment (PT) in women with CLD.
Design Prospective prevalence study; PT study in CLD subgroup.
Setting Tertiary metropolitan public hospital.
Participants Women with cystic fibrosis (CF, $n = 38$), chronic obstructive pulmonary disease (COPD, $n = 27$) and 69 healthy women without CLD. PT study — 10 women with CLD.
Interventions Five continence PT sessions over 3 months.
Main outcome measures Prevalence and impact of incontinence (questionnaire), number of leakage episodes (7-day accident diary), pelvic floor muscle function (ultrasound imaging) and quality of life (King's Health Questionnaire).
Results The majority of women in all three groups reported episodes of incontinence (CF 71%; COPD 70%; healthy women 55%). Compared to age-matched healthy controls, women with CF reported more episodes of incontinence ($P = 0.006$) and more commonly reported stress incontinence ($P = 0.001$). A logistic regression model revealed that women with CLD were twice as likely to develop incontinence than healthy women ($P = 0.05$). Women with COPD reported significantly more 'bother' with incontinence than age-matched women with incontinence. There was a significant reduction in incontinence episodes following treatment, which was maintained after three months.
Conclusions The presence of CLD is an independent predictor of incontinence in women. In older women this is associated with more distress than in age-matched peers without CLD. Larger treatment studies are indicated for women with CLD and incontinence.

Keywords: Chronic obstructive pulmonary disease; Cystic fibrosis; Lower urinary tract symptoms; Urinary incontinence; Women

Introduction

Symptoms of pelvic floor dysfunction are commonly experienced in women in the general population, are known to be underreported and have an adverse impact on quality of life [1]. These include urinary incontinence (incontinence) which is defined as the complaint of involuntary loss of urine and may be classified in conjunction with urgency, or as stress incontinence if associated with physical exertion, sneezing or coughing [2]. Known risk factors for the development of incontinence include increasing age, obesity and sex. Prevalence estimates range from 7 to 37% in women aged 20 to 39

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years, up to 30 to 61% in women aged 60 to 79 years, and are also affected by parity [3]. Women with chronic lung conditions may have disease-specific features, particularly chronic cough, which may result in the frequent report of symptoms of incontinence observed in clinical practice; however, to date there has been no direct comparison to healthy age-matched contemporaneous women without chronic lung disease.

Cystic fibrosis (CF) is characterised by the production of tenacious pulmonary secretions and chronic cough ultimately resulting in respiratory failure [4]. Significant improvements in treatment mean that people with CF may now live into their sixth decade. Current emphasis of treatment is not only increasing survival, but also improving quality of life. Previous work investigating incontinence in women with CF has reported predominantly stress incontinence and prevalence rates ranging between 30% and 76% [5–10] and an association with impaired quality of life [9,10].

Chronic obstructive pulmonary disease (COPD) is characterised by persistent and usually progressive airflow limitation leading to the development of symptoms including dyspnoea, chronic cough and sputum production [11]. 'Urinary incontinence' has a notable association with worse self-rated health in people with COPD, amongst other comorbid conditions which include diabetes and arthritis [12]. One group has previously demonstrated 49% prevalence of UI in women with COPD [13] with an adverse impact on quality of life [14].

There has also been limited investigation of the effect of treatment in women with chronic lung disease. It is not clear whether standard pelvic floor strengthening programs would be as effective in this group as in other populations, given the higher load on pelvic floor muscles generated by chronic cough. Improved pelvic floor muscle endurance has been demonstrated following physiotherapy intervention in women with CF [15], but there are no studies reporting pelvic floor muscle function and quality of life before and after specialised physiotherapy treatment in these patient populations.

The aims of the study were: (1) to determine the prevalence of incontinence symptoms in women with chronic lung disease (CF and COPD) compared to healthy women; (2) to assess the impact and 'bother' associated with these symptoms; (3) to identify risk factors for the development of incontinence; and (4) to provide preliminary data for the impact of a standard course of specialised physiotherapy treatment on symptoms of incontinence in women with chronic lung disease.

Patients and methods

Design

These prospective observational and pilot intervention studies received institutional ethics approvals from Alfred Health, La Trobe University and the University of Melbourne. All participants provided informed written consent.

Participants

Inclusion criteria were women aged 18 to 70 years who were able to read and write in English so to enable self-completion of the questionnaires. Women with a medical diagnosis of COPD or CF (conventional methods) were eligible in the absence of current symptoms suggestive of exacerbation of lung disease. 'Healthy' women reporting no history of diagnosed respiratory disease (e.g. asthma) were recruited via response to advertising flyers posted at local community centres. Women who were currently pregnant were excluded.

Intervention

Prevalence study

A purpose-designed questionnaire (including return stamped addressed envelope) was posted to eligible women with CF receiving outpatient care and hand delivered to women with COPD as they were attending a routine outpatient clinic review appointment at the hospital. Participants had the choice of completing the questionnaire independently or waiting until an investigator (JC) telephoned them four weeks after receiving the study package to provide assistance with the completion of the questionnaire. The questionnaire took 15 to 20 minutes to complete and was piloted with five women with chronic lung disease and five healthy women prior to implementation.

This questionnaire was designed to gather information about symptom type and impact, as well as risk factors for incontinence including age, body mass index (BMI), fluid intake, medications and comorbidities (Online supplement Table A). The hospital medical records of women with chronic lung disease were also reviewed to confirm current medications and comorbidities. Medications and comorbidities were categorised as 'relevant' based on prior documented associations with incontinence [16–18] and the number of women taking relevant medications or with relevant comorbidities recorded. Categories of relevant medications were antidepressants, narcotics, laxatives, diuretics, analgesics, tranquilisers, blood pressure medications, cardiac medications and anticonvulsants. Categories of relevant comorbidities were back pain, neurological disorder, arthritis, diabetes, cardiac conditions, hypertension and depression. Any reported history or surgery for prolapse in the questionnaire or noted in the medical record were recorded separately and dichotomised (yes/no).

Disease severity was assessed in women with chronic lung disease by FEV_1 (% predicted). Routine outpatient spirometry results (stable values closest to the time of questionnaire completion) were sourced from medical records.

The questionnaire enquired about a range of incontinence symptoms including storage and voiding problems, as well

as their impact ('bother') by asking participants to rate 'how much do your urinary symptoms interfere with your life?'. Control participants were grouped according to age range of participants with lung disease for subgroup analysis.

The presence of UI was dichotomised (yes/no) and defined as any report of incontinence.

Pilot treatment study

Women with chronic lung disease in the prevalence study with symptoms of stress urinary incontinence were invited to take part in a subsequent treatment study. All women who chose to participate underwent a 3-month treatment program. Participants were assessed at baseline, treatment completion (three months) and follow-up (three months following treatment completion, six months from baseline) by a specialist continence physiotherapist.

Outcome measures were number of leakage episodes (7-day accident diary) [19], muscle function as indicated by displacement of pelvic floor muscles on ultrasound imaging via the lower abdomen during three maneuvers (20 second maximum voluntary contraction, three deep coughs and three forced expirations) in three testing positions (supine, sitting and standing) and quality of life (King's Health Questionnaire) [20].

Each participant undertook a treatment program with a specialist continence physiotherapist comprising up to five treatments within a three-month period. Treatment consisted of pelvic floor muscle training which included teaching 'the knack' [21], a contraction of the pelvic floor prior to any activity that applies downward pressure on the pelvic floor such as during forced expiration, coughing, sneezing and weight bearing exercise such as jumping. Customised continence education, biofeedback, electrotherapy and bladder training (to learn to 'hold on' with a filling bladder) were used to enable optimal individualised pelvic floor muscle training. This functional training was accompanied by intensive daily pelvic floor strengthening exercises [22].

Analysis

All data were analysed using Statistical Package for the Social Sciences Version 24 (IBM Corp., Armonk, NY, USA). Categorical variables were described according to frequency, and continuous variables using descriptive statistics. Data were assessed using the Shapiro–Wilk test of normality prior to analyses. Normally distributed data were reported as mean [standard deviation (SD)] and non-normally distributed data were reported as median [interquartile range (IQR)]. Categorical data were analysed using the Chi-squared test. Normally distributed data were examined using the independent samples *t*-test, and non-normally distributed data were assessed using the non-parametric Mann–Whitney *U*-test. A logistic regression model was developed for the overall sample to test variables that could contribute to the development of UI. Variables for inclusion in the regression were selected according to study premise (diagnosed chronic lung disease) and known risk factors (age, obesity). Statistical significance was defined as $P < 0.05$.

Within-group analyses of the effect of treatment were performed (Friedman test).

Prevalence study

With 65 women without lung disease and 65 women with chronic lung disease, there would be an 85% chance of detecting a significant difference at a one-sided 0.05 significance level. This assumed that the response rate of women without lung disease was 0.4 [23] and the response rate of women with chronic lung disease was 0.65 [7].

Pilot treatment study

As there was no previous research available that measured the efficacy of physiotherapy interventions in this patient group and this was a preliminary study designed to inform future research, no sample size calculation was performed.

Results

Prevalence study

Questionnaires were completed by 134 participants (CF $n = 38$, COPD $n = 27$, healthy women $n = 69$). Demographic features of the groups of women with chronic lung disease were similar to the clinic profiles. Of these participants, four women with CF and six women with COPD went on to participate in the treatment study.

The majority of women in all three groups reported episodes of incontinence (CF 27/38, 71%; COPD 19/27, 70%; healthy women 38/69, 55%; Table 1). Only 3/38 (8%) of women with CF were parous, while numbers of women with COPD and healthy women were much higher and similar: COPD 18/27 (67%) vs 51/69 (74%) (Table 1).

Healthy women with incontinence were significantly older than those without incontinence ($P = 0.016$), however there was no relationship between incontinence and age in women with chronic lung disease, nor BMI in any group (Table 2). There were no significant differences between women with and without incontinence (within the groups with CF, COPD and healthy women) for history of pro-

Table 1
Characteristics of study participants by diagnosis group.

Characteristics	CF	COPD	Healthy women
Number of participants	38	27	69
Age (years), mean (SD)	32 (9)	63 (8)	43 (18)
Body mass index (kg/m^2), mean (SD)	22 (3)	26 (7)	24 (4)
Parous women, *n* (%)	3 (8%)	18 (67%)	51 (74%)
Reported urinary incontinence, *n* (%)	27 (71%)	19 (70%)	38 (55%)

CF: cystic fibrosis; COPD: chronic obstructive pulmonary disease; SD: standard deviation; *n*: number.

Table 2
Characteristics of participants by diagnosis group, according to status of urinary incontinence.

	CF			COPD			Healthy women		
	No UI	UI	*P*	No UI	UI	*P*	No UI	UI	*P*
Number of participants	11	27		8	19		31	38	
Age (years), median [IQR]	30 [26 to 38]	31 [23 to 40]	0.809	61 [58 to 68]	65 [55 to 72]	0.658	31 [24 to 48]	52 [29 to 57]	0.016*
BMI (kg/m^2), median [IQR]	20 [19 to 22]	21 [20 to 24]	0.394	23 [20 to 30]	29 [23 to 32]	0.244	23 [21 to 25]	24 [21 to 25]	0.624
FEV_1 (% predicted), median [IQR]	66 [57 to 72]	56 [43 to 79]	0.246	49[a]	67 [39 to 76][b]	0.606	–	–	–
Cups of fluid per day, mean (SD) or median [IQR]	9 (2)	9 (2)	0.705	8 [5 to 9]	10 [8 to 13]	0.034*	9 (3)	9 (3)	0.715
Relevant medications, *n*	10	2	0.257	14	4	0.233	6	4	0.735
Relevant comorbidities, *n*	11	4	0.802	16	7	0.826	15	7	0.134
History of prolapse, *n*	0	1	0.518	0	6	0.072	3	6	0.453

CF: cystic fibrosis; COPD: chronic obstructive pulmonary disease; UI: urinary incontinence; IQR: interquartile range; BMI: body mass index; FEV_1: forced expiration volume in one second; SD: standard deviation; *n*: number.
[a] $n = 2$.
[b] $n = 10$.
* Significance $P < 0.05$ (UI vs no UI within diagnosis groups).

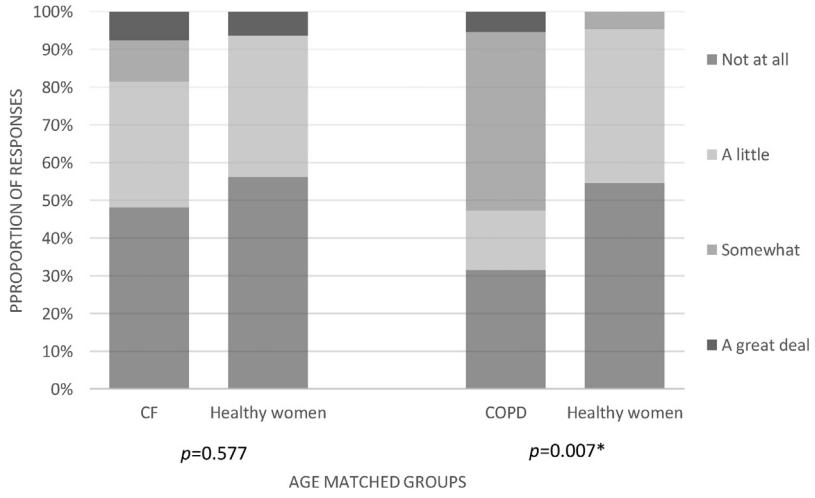

Fig. 1. Reported 'bother' for symptoms of urinary incontinence by diagnosis groups compared to age-matched healthy women.
*Significance $P < 0.05$ (between diagnosis groups and age-matched healthy women).
CF: cystic fibrosis; COPD: chronic obstructive pulmonary disease.

lapse, number of medications or co-morbidities. Women with COPD reported significantly more 'bother' with incontinence than age-matched healthy women. Women with CF, while experiencing significantly more stress incontinence than the age-matched healthy group, were not significantly different in terms of 'bother' factor (Fig. 1).

Incontinence was significantly more common in women with CF compared to age-matched healthy women (CF 27/31, 71%, age-matched healthy women 16/40, 40%; $P = 0.006$). Stress incontinence was most common, and reported more frequently by women with CF (CF 25/31, 66%, age-matched healthy women 8/40, 20%; $P = 0.001$). This was in contrast to women with COPD and healthy controls where there were no significant differences (Table 3).

A logistic regression model that included age, BMI and diagnosed lung disease revealed that women with chronic lung disease were twice as likely to develop incontinence as women without lung disease ($P = 0.05$; Table 4).

Pilot treatment study

Four women with CF (mean age 37 (SD 4) years, BMI 22 (1) kg/m^2) and six women with COPD (60 (2) years, 32 (3) kg/m^2) participated in the treatment study.

There was no statistically significant improvement in the King's health questionnaire between baseline and the end of the treatment period (Online supplement Table B). There was a significant reduction in the number of incontinence episodes after three months of treatment (Online supplement Table C). In addition, the severity of leakage was improved, as seen by the reduced number of wet episodes following the treatment that was sustained for a further three months.

Following treatment, there was a significant increased positive displacement of the pelvic floor in a cephalad direction during a maximum voluntary contraction in sitting and forced expiration in standing, as objectively measured with ultrasound imaging (Online supplement Table D).

Table 3
Characteristics and questionnaire results for participants by diagnosis groups compared to age-matched healthy women.

	CF	Healthy women	*P*	COPD	Healthy women	*P*
Number of participants	38	40	–	27	29	–
Age (years), median [IQR]	31 [26 to 40]	26 [22 to 36]	0.145	63 [55 to 69]	56 [52 to 69]	0.403
BMI (kg/m^2), median [IQR]	21 [20 to 23]	22 [20 to 24]	0.128	27 [21 to 31]	25 [23 to 27]	0.378
Reported UI, *n* (%)	27 (71)	16 (40)	0.006*	19 (70)	22 (76)	0.643
Reported urgency, *n* (%)	8 (21)	9 (23)	0.877	12 (44)	12 (41)	0.977
Urgency UI, *n* (%)	5 (13)	8 (20)	0.418	11 (41)	13 (45)	0.757
Stress UI, *n* (%)	25 (66)	8 (20)	0.001*	16 (59)	14 (48)	0.410
Nocturia, *n* (%)	4 (11)	1 (3)	0.148	0	2 (7)	0.165
Pain with passing urine, *n* (%)	1 (3)	0	0.302	1 (4)	0	0.296
Difficulty passing urine, *n* (%)	3 (8)	1 (3)	0.280	6 (22)	2 (7)	0.101
Urine leakage for no reason, *n* (%)	3 (8)	1 (3)	0.280	4 (15)	2 (7)	0.338
History of prolapse, *n* (%)	1 (3)	3 (8)	0.330	6 (22)	6 (21)	0.889

CF: cystic fibrosis; COPD: chronic obstructive pulmonary disease; BMI: body mass index; UI: urinary incontinence; IQR: interquartile range; *n*: number.
* Significance $P < 0.05$ (between diagnosis groups and age-matched healthy women).

Table 4
Logistic regression for predictors of urinary incontinence in whole sample ($n = 134$).

	B	S.E.	Wald	df	Sig.	Exp (B)	95% confidence interval for Exp (B)	
							Lower	Upper
Chronic lung disease (yes/no)	0.740	0.378	3.842	1	0.050	2.096	1.000	4.395
Age (years)	0.015	0.012	1.539	1	0.215	1.015	0.992	1.038
Body mass index (kg/m^2)	0.023	0.046	0.245	1	0.621	1.023	0.935	1.119
Constant	−0.964	1.044	0.853	1	0.356	0.381		

*Significance $P < 0.05$.

Discussion

This is the first study to compare the prevalence of different types of pelvic floor dysfunction in women with chronic lung disease (CF and COPD) with contemporaneous age-matched healthy women. Women with CF reported more incontinence than the age-matched group, with stress incontinence the most common type. Whilst women with COPD were not significantly different from their age-matched group in terms of prevalence of symptoms, these women reported higher levels of bother with their symptoms of incontinence. This difference in bother was not seen in the women with CF.

Despite documented associations in the general population [3], BMI was not significantly different for women with incontinence within the lung disease and healthy groups. Severity of lung disease was also not significantly different for women with incontinence and either CF or COPD. However, logistic regression showed that the diagnosis of a chronic lung disease was associated with twice the risk of developing incontinence.

The results of our study are concordant with previously published uncontrolled prevalence data on incontinence in women with CF [7,9,10] and higher than previously reported in women with COPD [13]. Together with the findings for greater bother in women with COPD, these results highlight the scale and importance of this problem for women managing the burden of chronic lung disease as well as symptoms of incontinence. The prevalence of stress incontinence in women with CF also provides impetus to consider the impact of treatment requirements on symptoms of incontinence, and the impact of incontinence symptoms on ability to participate in treatment regimes routinely incorporating coughing and exercise.

Our study did show encouraging preliminary results following a three-month treatment phase in women with chronic lung disease; the significant decrease in number of wet episodes reported after the program was maintained for a further three months. These findings are consistent with work showing supervised pelvic floor muscle training resulted in improved symptoms and muscle endurance in women with CF [15]. The use of ultrasound in this study enabled objective measurement of pelvic floor muscle function and demonstration of changes over time. The lack of improvement in quality of life may reflect the lack of sensitivity of the assessment tool in this small sample with chronic lung disease, given the improvement in symptoms of incontinence.

At the time of this study, no standardised tools were available, necessitating development of the questionnaire used. This study did rely on self-report of symptoms of incontinence, and was subject to volunteer bias; however, the demographics of the participant groups were consistent with clinic features. The small number of women who went on to participate in the treatment program may reflect the logistical requirements for service provision (location, timing of appointments with competing demands) which are important considerations for future work.

Conclusions

This is the first study to compare prevalence rates of pelvic floor dysfunction in women with chronic lung disease with healthy women. The presence of chronic lung disease was an independent predictor of incontinence, when controlling for age and BMI and no relationship was seen with disease severity. A specialised physiotherapy intervention reduced incontinence in women with chronic lung disease, and warrants examination in a larger study. The prevalence and impact of incontinence in women with chronic lung disease highlights the need for identification of pelvic floor dysfunction and prompt referral for assessment, education and treatment at a specialist continence clinic.

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Ethical approval: This study received approval from the Human Research Ethics Committees at the Alfred Hospital (108/01).

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Conflict of interest: None declared.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.physio.2018.07.006.

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