

Interstitial lung abnormalities and self-reported health and functional status

ABSTRACT

We investigated the association between interstitial lung abnormalities (ILA) and self-reported measures of health and functional status in 5764 participants from the Age, Gene/Environment Susceptibility-Reykjavik study. The associations of ILA to activities of daily living (ADLs), general health status and physical activity were explored using logistic regression models. Participants with ILA were less likely to be independent in ADLs (OR 0.70; 95% CI 0.55 to 0.90) to have good or better self-reported health (OR 0.66; 95% CI 0.52 to 0.82) and to participate in physical activity (OR 0.72; CI 0.56 to 0.91). The results demonstrate ILA's association with worsening self-reported health and functional status.

INTRODUCTION

Interstitial lung abnormalities (ILA) includes a set of precisely defined CT changes, similar to those used to detect interstitial lung disease (ILD), but are often of a lesser magnitude.¹⁻³ The argument for the relation of ILA to ILD has been strengthened by the association of ILA to several factors, including reductions

in total lung capacity and an increase in mortality.^{1,3,4} Other notable associations of ILA include increased age, decreased diffusion capacity, in addition to shortness of breath with exertion, and chronic cough.^{1,2,5} Despite these associations, little is known about the relationship between ILA and self-reported measures of health and functional status.

METHODS

To explore these associations, data were obtained from the Age, Gene/Environment Susceptibility-Reykjavik (AGES-Reykjavik) study. Details of the study design have been previously published.⁶ Informed consent was obtained from all participants. Two separate CT scans of the thorax were obtained with a four-row CT scanner (Sensation, Siemens Medical System, Erlangen, Germany) that covered about 95% of the lungs, omitting the superior portion of the apices. The axial images were evaluated by up to three readers (pulmonologists and chest radiologists) blinded to participant-specific information, using a sequential reading method as previously described.¹ Scans labelled as ILA, indeterminate and 20% of normal scans were read by two readers and the third reader provided majority opinion on discordantly labelled scans. ILA was defined as 'non-dependent

changes affecting more than 5% of any lung zone, including reticular or ground-glass abnormalities, diffuse centrilobular nodularity, non-emphysematous cysts, honeycombing or traction bronchiectasis' while 'focal or unilateral ground-glass attenuation, focal or unilateral reticulation or patchy ground-glass abnormalities (<5% of any lung zone)' were defined as indeterminate changes. The data on smoking status, health status, activities of daily living (ADLs) and physical activity were obtained from participant questionnaires.⁶ The question regarding health status was 'In general, how would you say your health is?', with the answers ranging from 1 ('excellent') to 5 ('poor'). For statistical analyses, participants were categorised into two groups based on whether they perceived their health as 'good' or better. Thus, one group was composed of participants that perceived their health as 'good', 'very good' or 'excellent', while participants that perceived their health as 'poor' or 'fair' made up the other group. ADLs were assessed by asking participants whether they had difficulties performing the following five activities: bathing, dressing, walking from room to room, transferring out of bed/chair or eating.⁷ For statistical analyses, participants were grouped into two groups: people independent in all ADLs and people

Table 1 Baseline characteristics of participants

Participants	No ILA (n=3216, 61%)	Indeterminate ILA status (n=1726, 32%)	ILA (n=378, 7%)	P value
Mean age (95% CI)	75.9 (75.7 to 76.1)	77.4 (77.1 to 77.6)	77.8 (77.2 to 78.3)	3.4×10 ⁻⁹
Women, n (%)	1910 (59)	962 (56)	172 (46)	3.1×10 ⁻⁷
Mean BMI (95% CI)	27.2 (27.0 to 27.3)	26.8 (26.6 to 27.0)	27.1 (26.6 to 27.5)	0.60
History of smoking, n (%)	1750 (54)	1021 (59)	271 (72)	1.1×10 ⁻¹⁰
Median pack-years (IQR)	0 (0–16)	2.5 (0–22.5)	11.0 (0–28.5)	3.5×10 ⁻¹⁶
Current smoker, n (%)	374 (12)	205 (12)	69 (18)	0.0003
Activities of daily living				
Independence in all five ADLs, n (%)	2422 (75)	1191 (69)	251 (66)	
Independence in four ADLs, n (%)	434 (13)	253 (15)	65 (17)	
Independence in three or less ADLs, n (%)	336 (10)	259 (15)	54 (14)	
Health status				
Health described as 'excellent', n (%)	742 (23)	368 (21)	70 (19)	
Health described as 'very good', n (%)	480 (15)	225 (13)	38 (10)	
Health described as 'good', n (%)	1010 (31)	512 (30)	109 (29)	
Health described as 'fair', n (%)	813 (25)	503 (29)	128 (34)	
Health described as 'poor', n (%)	166 (5)	114 (7)	31 (8)	
Physical activity in the past 12 months				
No or rare physical activity, n (%)	1914 (60)	1115 (65)	258 (68)	
Weekly physical activity, n (%)	1263 (39)	580 (34)	108 (29)	

P values comparing participants without ILA and participants with ILA.

ADLs, activities of daily living; BMI, body mass index; ILA, interstitial lung abnormalities.

Table 2 Associations of ILA with measures of health

	Unadjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Independence in activities of daily living				
No ILA	1.00	0.0008	1.00	0.0051
ILA	0.67 (0.53 to 0.85)		0.70 (0.55 to 0.90)	
Health status perceived as good or better*				
No ILA	1.00	4.0×10 ⁻⁶	1.00	0.0003
ILA	0.60 (0.48 to 0.75)		0.66 (0.52 to 0.82)	
Participation in physical activity				
No ILA	1.00	0.0002	1.00	0.0076
ILA	0.63 (0.50 to 0.80)		0.72 (0.56 to 0.91)	

Associations were estimated with logistic regression models. The adjusted models are adjusted for sex, body mass index, age, pack-years and current smoking status as covariates.

*This includes self-reports of health status perceived as 'good', 'very good' and 'excellent', as opposed to 'poor' or 'fair'.

ILA, interstitial lung abnormalities.

dependent in one or more ADLs. Physical activity was estimated by asking participants how many hours per week, during the last 12 months, they participated in moderate-vigorous intensity physical activity. The possible answers were never, rarely, every week but less than 1 hour, 1–3 hours per week, 4–7 hours per week and more than 7 hours per week. For statistical analyses, people were categorised into two groups: people who never or rarely participated in physical activity and those who did so at least weekly. Comparisons of baseline characteristics were done using X^2 tests, t-tests and Wilcoxon rank-sum tests as appropriate. The analysis of the association of ILA with measures of health and functional status was done using logistic regression modelling. Participants with indeterminate ILA status were excluded from these analyses. The measures of health were assigned to multivariable models adjusted for covariates including age, sex, body mass index (BMI), pack-years of smoking and current smoking status. All statistical analyses were done using R V.3.3.2.

RESULTS

The baseline characteristics of the participants in the AGES-Reykjavik cohort for which CT imaging data were available (5320 of 5764 or 92%) are shown in table 1. Similar to previous reports,³ people with ILA were significantly older and more often male than people without ILA. Participants with ILA were more likely to have a history of smoking, had a higher number of pack-years and were more often smokers at the time of data collection. Results regarding the associations between measures of health with ILA are shown in table 2. Associations with ILA were observed for all metrics of self-reported health and functional

status. Odds of independence in ADLs were decreased among participants with ILA (OR 0.70; 95% CI 0.55 to 0.90, $P=0.0052$) compared with people free of ILA (table 2). The same applied to worse health; people with ILA were significantly less likely to have good or better self-reported health status than people without ILA (OR 0.66; 95% CI 0.52 to 0.82, $P=0.0003$). People with ILA were less likely to participate in physical activity (OR 0.72; 95% CI 0.56 to 0.91, $P=0.0076$) as shown in table 2.

DISCUSSION

These data demonstrate that ILA is associated with worse self-reported health and functional status in the AGES-Reykjavik study. This study extends previous findings^{1–3, 8} demonstrating that, even though not diagnosed, research participants with ILA may, in some cases, share similar health outcomes as patients with ILD.

More than one reason is possible for these associations. First, it is possible that the reductions in self-reported health and functional status are being driven by the underlying, interstitial abnormalities. Another possibility is that similar underlying biological factors can cause both ILA and reduced measures of health and functional status. Lastly, it is possible that unmeasured confounders could, in part, explain some of these findings of association. These findings demonstrate that in the AGES-Reykjavik cohort, people with ILA have poorer self-reported health and reduced functional status. These results add to previous suggestions that research programmes aimed at improving treatment and prevention of ILD could benefit from directing their efforts to early stages of ILD.^{3, 9} In conclusion, ILA are associated with measures of decreased health among elderly people.

Gisli Thor Axelsson,^{1,2} Rachel K Putman,³ Tetsuro Araki,^{4,5} Sigurdur Sigurdsson,¹ Elias Freyr Gudmundsson,¹ Gudny Eiriksdottir,¹ Thor Aspelund,^{1,2} Ezra R Miller,³ Lenore J Launer,⁶ Tamara B Harris,⁶ Hiroto Hatabu,^{4,5} Vilundur Gudnason,^{1,2} Gary Matt Hunninghake,^{3,5} Gunnar Gudmundsson^{2,7}

GTA and RKP contributed equally.

¹Icelandic Heart Association, Kopavogur, Iceland

²Faculty of Medicine, University of Iceland, Reykjavik, Iceland

³Pulmonary and Critical Care Division, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts, USA

⁴Department of Radiology, Brigham and Women's Hospital, Boston, Massachusetts, USA

⁵Center for Pulmonary Functional Imaging, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts, USA

⁶Intramural Research Program, National Institute on Aging, Bethesda, Maryland, USA

⁷Department of Respiratory Medicine, Landspítali University Hospital, Reykjavik, Iceland

Correspondence to Dr Gunnar Gudmundsson, Department of Respiratory Medicine, Landspítali University Hospital, Reykjavik IS-108, Iceland; ggudmund@landspitali.is

Contributors Study design: HH, VG, GMH and GG. Acquisition, analysis or interpretation of the data: GTA, RKP, TAs, SS, EFG, GE, TAR, HH, VG, GMH and GG. Statistical analysis: GTA, RKP, TAs and GMH. Obtained funding: VG, GMH and GG. All authors contributed to the critical revision of the manuscript for important intellectual content.

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