Dyspnoea and mortality in older people in the community: a 10-year follow-up

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Abstract

Background: examine baseline dyspnoea and subsequent 10-year mortality adjusting for age and gender and determine whether dyspnoea is related to early or late mortality or both. Examine the relationship between dyspnoea and mortality adjusting for confounding effects of underlying diseases.

Methods: we sent modified Medical Research Council (MRC) dyspnoea questionnaire to identify breathlessness in 1,404 randomly selected subjects from general practitioner lists of 5,002 subjects aged 70 years and over living in the community. A further random sample of 500 subjects underwent clinical assessment including pulmonary function tests, electrocardiography and echocardiography. Subjects were followed up for 10 years and all deaths were recorded, using general practitioner records and the local death registry.

Results: prevalence of dyspnoea was 32.3%. Breathlessness was associated with early mortality and late mortality. At 2 years 10.1% breathless subjects died compared with 3.4% non-breathless (P = 0.02). At 10 years 63.3% breathless had died compared with 40.5% non-breathless (P = 0.0001). Increasing grade of MRC dyspnoea was associated with 10 mortality. Advancing age (OR: 2.27), male gender (OR: 1.95), breathlessness (OR: 2.53), left ventricular dysfunction (OR: 5.01) and chronic airways disease (OR: 3.04) were all significantly associated with 10-year mortality. After adjustment of age, gender and underlying diseases breathlessness was associated with 10-year mortality (P = 0.02).
Introduction

Dyspnoea is common in older people in the community, its reported prevalence varying from 20 to 60% [1, 2]. It is associated with poor functional status, reduced physical and mental health [3, 2]. Dyspnoea is also common among older people admitted to hospital. Despite this, very little research has been undertaken into dyspnoea in older people.

Common conditions are often under recognised and under treated in older people. Patients may attribute their symptoms to old age resulting in non-presentation or delayed presentation [4]. For example, asthma is often perceived to be a disease of childhood and young adults and is under diagnosed in older people [5]. It may be confused with chronic obstructive pulmonary disease (COPD) and is associated with excess morbidity and mortality in older people [6, 7]. Perception of bronchoconstriction in asthmatic patients falls throughout adulthood and studies of methacholine challenge have demonstrated increased airways resistance is poorly perceived by older subjects with and without asthma [8, 9]. Additionally heart failure can be difficult to diagnose, symptoms and signs being non-specific. Only a third of older people in the community with left ventricular dysfunction are on appropriate treatment [10]. Heart failure and COPD often co-exist in older people, contributing to diagnostic confusion [11].

Furthermore, in addition to breathlessness being common, limited research suggests that breathlessness is an important predictor of mortality in older populations. To date there have been two studies in older people. The PAQUID study, a French community-based study of 2,792 subjects aged over 65, found breathlessness was closely related to mortality even after adjustment for age sex, smoking and occupation. (i) A Dutch study of 124 older subjects found dyspnoea predicted mortality and disability. (ii) Neither study investigated underlying causes of breathlessness and the reasons for excess mortality.

The aims of our study were to examine baseline dyspnoea in community-based older people (aged ≥70 years old) from the UK and subsequent 10-year mortality adjusting for age and gender and the confounding effects of underlying diseases such as left ventricular dysfunction and COPD.

Methods

We randomly selected 1,404 subjects from general practice lists of 5,002 subjects aged 70 years and over living at home in the South Wales town of Barry. This was a population-based study of disease prevalence in older people living in their own homes. Care home residents were excluded because they tend to be older, with higher levels of morbidity, and hence not representative of the general population living in their own homes. The town has a population of 62,000 with an age and social class structure representative of the general population in England and Wales.

We sent a modified Medical Research Council (MRC) dyspnoea questionnaire [12] to all subjects, followed by a second mailing and telephone call to non-responders. Of those who responded, a stratified random sample of 250 breathless and 250 non-breathless were visited at home by a research nurse who administered questionnaires to assess function and quality of life. The prevalence of arthritis, diabetes mellitus, previous strokes and ischaemic heart disease were determined by direct questioning of all subjects in the subsample. Research participants attended a centre for clinical assessment, pulmonary function tests, electrocardiography and echocardiography.

Breathlessness was defined as MRC grade 3–5, as in other studies [13, 14]. Reversible airways disease was diagnosed as ≥15% reversibility in FEV1 following 5 mg nebulised salbutamol, and COPD as both FEV1 and FEV1/FVC ratio being less than the lower limits of normal for older people [15]. The left ventricular function was assessed by echocardiography, analysed by two of three independent observers. Global left ventricular function was assessed as normal or mildly, moderately or severely impaired. Disagreement between the observers was adjudicated by the third observer.

Subjects were followed up for 10 years and all deaths were recorded, using general practitioner records and the local death registry. Ethical approval was obtained. Statistical analysis was done using STATA with adjustment for the survey design. Population prevalences with 95% confidence intervals were estimated from the subsample, taking into account the random variation from the two-stage sampling. Empirical estimates of 10-year survival curves were calculated using Kaplan–Meir methods. Univariate and multivariate analysis of predictors of mortality was carried out using logistic regression modelling, using an adjustment for the survey design available in STATA. Logistic regression was used in preference to Cox proportional hazards regression as some covariates exhibited gross departure from the proportional hazards assumptions.

Results

Of the 1,404 subjects approached, 1,169 (91% of eligible cases) responded to the postal questionnaire. From the
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subsample of 500 subjects, 425 had full medical assessments (92% eligible cases; 39 being ineligible due to death, move to care home and cognitive impairment). Of these 423 were followed up at 10 years.

The population prevalence of dyspnoea (MRC grade 3–5) was 32.3% (95% confidence intervals 30.3, 34.3); 27.4% in men and 35.4% in women. The mean age of breathlessness subject was 77.2 years old compared with 78.3 in non-breathless (P = 0.04). Dyspnoea was associated with reversible airways disease (P = 0.009), COPD (P = 0.0003) and left ventricular dysfunction (P = 0.0001). The prevalence of COPD was 19.3%, reversible airways disease 19.3% and LVSD 17.1% in the breathless population. There was some overlap between COPD and reversible airways disease, 6% of COPD subjects had reversibility. Breathless subjects were more likely to have at least one of these diseases than non-breathless subjects (46.1 versus 23.7%, P < 0.001). The mean age of the cohort at baseline was 77.6 years old, 37.8% were men, 62.2% were women and 54.8% were social class III.

Increasing age was strongly associated with mortality (P = 0.0010) as was male gender (P = 0.0037). From survey estimation, 55.6% (47.0, 64.0) men had died at 10 years compared with 39% (32.6, 46.1) women. In Figure 1, 10-year survival curves are shown for different age groups, men and women.

Self-reported illnesses including angina (P = 0.03), myocardial infarction (P = 0.01), hypertension (P = 0.01) were associated with subsequent 10-year mortality but stroke (P = 0.06), diabetes (P = 0.12), arthritis (P = 0.6) were not significantly associated. Social class had no effect on mortality (P = 0.9).

Examining breathlessness and early mortality (at 2 years) 10.1% (5.8, 17.0) breathless had died compared with 3.4% (2.1, 7.1) non-breathless (P = 0.02). At 10 years 63.3% (53.8, 71.8) breathless had died compared with 40.5% (34.3, 47.0) non-breathless (P = 0.0001) (Figure 1).

Increasing MRC grade of breathlessness was associated with a higher mortality, both at 2 years (P = 0.0347) and 10 years (P = 0.0005). At 10 years the mortality was 90.8% (55.9, 98.8), 68.0% (53.6, 77.3), 53.6% (39.3, 67.4), 46.5% (35.3, 58.1) and 38.2% (30.9, 46.0) for MRC grade 5 dyspnoea to grade 1. The main cause of death was cardiac (26%) followed by respiratory (21%), neoplastic (21%) and stroke (10%). There was no significant relationship between breathlessness and cause of death. (P = 0.18)

On univariate logistic regression analysis, advancing age (OR: 2.27), male gender (OR: 1.95), breathlessness (OR: 2.53), left ventricular systolic dysfunction (OR: 5.01), FEV (OR: 2.95) and COPD (OR: 3.04) were all significantly associated with the 10-year mortality. The model that best predicted 10-year mortality was logistic regression. After adjusting for the effects of age, gender, left ventricular dysfunction, FEV and COPD breathlessness remained significantly associated with the 10-year mortality (OR: 1.94 P = 0.020). Summaries of univariate and multi-logistic regression are shown in Table 1.

Discussion

We have found that dyspnoea in older people (aged ≥70 years old) is significantly associated with mortality even when age, gender and underlying diseases are taken into account. These results are consistent with earlier studies showing an association between dyspnoea and mortality in older people. Increasing grade of dyspnoea was strongly associated with mortality.

The strengths of our study include community base of the cohort, random sample, length of follow-up and completeness of data. Subjects had a thorough cardio-respiratory work up at baseline so diseases associated with breathlessness were diagnosed. Limitations are that we may have underestimated self-reported conditions such as diabetes and stroke. We have probably underestimated the burden of breathlessness in older people because we excluded those in hospital, care homes and those with cognitive impairment.

In our study dyspnoea was associated with mortality in older people, even if people did not have heart failure or COPD. This is an interesting finding and leads us to speculate that in addition to breathlessness being a marker of underlying diseases such as heart failure and COPD [16, 17] in older people breathlessness may be a marker of frailty. There is evidence for an association between breathlessness and sarcopenia in patients with COPD [18]. The
Dyspnoea could be considered a geriatric syndrome. After adjustment for age, gender and underlying diseases, it is associated with early and late mortality. Dyspnoea is common, present in up to a third of older people. Age (75–79 years) 1.0
Age (80–84 years) 2.27 (0.61) 0.002 (1.34, 3.85)
Age (85+ years) 2.63 (0.71) 0.001 (1.47, 4.75)
Gender (male) 1.95 (0.46) 0.004 (1.24, 3.07)
MRC grade 3–5 2.53 (0.61) 0.000 (1.56, 4.06)
LVSD (present) 5.01 (2.00) 0.000 (2.31, 10.9)
COPD (present) 3.04 (1.09) 0.001 (1.54, 6.18)
FEV1 < 0.5 2.95 (1.38) 0.020 (1.17, 7.41)
RAD (present) 1.49 (0.44) 0.181 (0.83, 2.68)

Table 1. Univariate and multivariate (survey) logistic regression analysis for the 10-year mortality

Univariate analysis Multivariate analysis
Odds ratio (SE) P-value 95% CI Odds ratio (SE) P-value 95% CI
Age (75–79 years) 1.0 1.0
Age (80–84 years) 2.27 (0.66) 0.005 (1.28, 4.02)
Age (85+ years) 2.90 (1.00) 0.002 (1.47, 5.71)
Gender (male) 1.97 (0.53) 0.010 (1.20, 3.30)
MRC grade 3–5 1.94 (0.55) 0.020 (1.11, 3.38)
LVSD (present) 4.66 (2.06) 0.001 (1.94, 11.1)
COPD (present) 2.82 (1.27) 0.018 (1.20, 6.83)
FEV1 < 0.5 1.05 (0.55) 0.925 (.544, 2.21)
RAD (present) 1.10 (0.39) 0.800 (0.54, 2.20)

The fact that breathlessness in our original study was strongly associated with disability [3] and in the current study with mortality reinforces the need for a problem-based approach in geriatric medicine, rather than just a focus on disease. It could be argued that breathlessness should be considered a geriatric syndrome [19]. It is highly prevalent in older people and includes physiological components (increased lung compliance, increased chest wall stiffening, falling FEV1), disease components and is associated with poor function and adverse outcomes in older people.

Key points

- Dyspnoea is common, present in up to a third of older people.
- It is associated with early and late mortality.
- After adjustment for age, gender and underlying diseases, dyspnoea is an independent predictor of death.
- Dyspnoea could be considered a geriatric syndrome.

Conflicts of interest

None declared.

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References

The effect of virtual reality gaming on dynamic balance in older adults

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Abstract

Background: physical therapy interventions that increase functional strength and balance have been shown to reduce falls in older adults.
Aim: this study compared a virtual reality group (VRG) and a control group (CG).
Design: randomised controlled 6-week intervention with pre- and post-test evaluations.
Setting: outpatient geriatric orthopaedic and balance physical therapy clinic.
Population: forty participants were randomised into two groups.
Method: the VRG received three different Nintendo® Wii FIT balance interventions three times per week for 6 weeks and the CG received no intervention.
Results: compared with the CG, post-intervention measurements showed significant improvements for the VRG in the 8-foot Up & Go test [median decrease of 1.0 versus −0.2 s, \( P = 0.038 \)] and the Activities-specific Balance Confidence Scale (6.9 versus 1.3%) \( P = 0.038 \).
Conclusion: virtual reality gaming provides clinicians with a useful tool for improving dynamic balance and balance confidence in older adults.

Keywords: balance, virtual reality gaming, older adult, randomised, elderly

Introduction

In the USA, falls are the leading cause of injury death in adults 65 years of age and older accounting for approximately 10,000 deaths annually [1, 2]. Every year approximately 33–50% of people 65 years and older experience a fall [3–6]. Functional mobility and balance confidence are critical components of the multi-faceted treatment approach for an ageing population with increased fall risk.

Virtual reality gaming is an emerging technology that is being used for that purpose. A variety of health care practitioners are using virtual reality technology to enhance patient treatments as well as provide multiple innovative interventions requiring attention and active patient participation [7, 8]. In 2005, Shigeru Miyamoto designed the Nintendo® Wii with its innovative remote and Wii Balance Board (WBB) control [9]. The WBB is portable, widely available, and inexpensive balance assessment tool suitable for balance training.