Brief Report

The Effect of 20-Minute Mindful Breathing on the Rapid Reduction of Dyspnea at Rest in Patients With Lung Diseases: A Randomized Controlled Trial

Seng-Beng Tan, MBBS, MRCP, Chong-Kin Liam, MBBS, FRCP, Yong-Kek Pang, MD, MRCP, Diana Leh-Ching Ng, MD, MMED, Tat-Seng Wong, MBBS, Kelvin Wei-Shen Khoo, MBBS, Chieh-Yin Ooi, MBBS, and Chee-Shee Chai, MD, MMED

Department of Medicine (S.-B.T., C.-K.L., Y.-K.P., T.-S.W., K.W.-S.K., C.-Y.O.), Faculty of Medicine, University of Malaya, Kuala Lumpur; and Department of Medicine (D.L.-C.N., C.-S.C.), Faculty of Medicine and Health Science, University Malaysia Sarawak, Kota Samarahan, Sarawak, Malaysia

Abstract

Context. Dyspnea is a common and distressing symptom in respiratory diseases. Despite advances in the treatment of various lung diseases, the treatment modalities for dyspnea remain limited.

Objectives. This study aims to examine the effect of 20-minute mindful breathing on the rapid reduction of dyspnea at rest in patients with lung cancer, chronic obstructive pulmonary disease, and asthma.

Methods. We conducted a parallel-group, nonblinded, randomized controlled trial of standard care plus 20-minute mindful breathing vs. standard care alone for patients with moderate to severe dyspnea due to lung disease, named previously, at the respiratory unit of University Malaya Medical Centre in Malaysia, from August 1, 2017, to March 31, 2018.

Results. Sixty-three participants were randomly assigned to standard care plus a 20-minute mindful breathing session ($n = 32$) or standard care alone ($n = 31$), with no difference in their demographic and clinical characteristics. There was statistically significant reduction in dyspnea in the mindful breathing group compared with the control group at minute 5 ($U = 233.5$, $n_1 = 32$, $n_2 = 31$, mean $rank_1 = 23.28$, mean $rank_2 = 37.72$, $z = -3.574$, $P < 0.001$) and minute 20 ($U = 232.0$, $n_1 = 32$, $n_2 = 31$, mean $rank_1 = 23.00$, mean $rank_2 = 36.77$, $z = -3.285$, $P = 0.001$).

Conclusion. Our results provide evidence that a single session of 20-minute mindful breathing is effective in reducing dyspnea rapidly for patients with lung cancer, chronic obstructive pulmonary disease, and asthma. J Pain Symptom Manage 2019;57:802–808.

Key Words

Mindfulness breathing, dyspnea, palliative, lung cancer, chronic obstructive pulmonary disease, asthma

Introduction

Dyspnea is defined by The American Thoracic Society as a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity.[1] It arises from interactions among multiple physiological, psychological, social, and environmental factors and may induce secondary physiological and behavioral responses.[1,2] Although the underlying mechanisms of dyspnea have not been fully elucidated, the prevailing theory suggests dyspnea is a result of a neuromechanical dissociation, in which there is a mismatch between the motor command and the sensory feedback.[3,4] In other words, dyspnea occurs when the need of breathing is not met by the work of breathing.

Address correspondence to: Chee-Shee Chai, MD, MMED, Senior Medical Lecturer, Department of Medicine, Faculty of Medicine and Health Science, University Malaysia Sarawak, Jalan Datuk Mohd Musa, Kota Samarahan 94300, Sarawak, Malaysia. E-mails: cschai@unimas.my or cheeshee1981@gmail.com

Accepted for publication: January 14, 2019.

0885-3924/$ - see front matter
https://doi.org/10.1016/j.jpainsymman.2019.01.009

The prevalence of dyspnea is reported to be as high as 50%–87% in lung cancer patients, 56%–98% in chronic obstructive pulmonary disease (COPD) patients, and 91%–95% in acute asthma patients.[5–7] A significant 39% of terminally ill patients experience dyspnea in the last two weeks of their lives.[8] Dyspnea, a common and distressing symptom that is associated with anxiety, insomnia, and fatigue, causes prolonged hospital stays and severely impairs quality of life.[9] Patients with lung diseases experience varying degrees of dyspnea with significant unpleasantness. To manage dyspnea effectively, recognition of its high prevalence, optimizing treatment of the underlying disease, and a holistic and comprehensive approach to symptom control are necessary.

Although there are significant advances in the etiologic treatment of dyspnea, there has been little progress in symptomatic treatment. Among all pharmacological interventions, opioids are the most widely studied treatment.[10] Aside from asthma, opioids have been found to reduce breathlessness due to lung diseases such as lung cancer, COPD, and lung fibrosis.[10–12] All other pharmacological options commonly prescribed for dyspnea have limited evidence, including supplemental oxygen, benzodiazepines, phenothiazines, nebulized frusemide, and corticosteroids.[2,13] Although there is evidence to support the integration of pulmonary rehabilitation to manage COPD patients and the use of battery-operated handheld fan to reduce dyspnea, there are limited data on the use of other nonpharmacological interventions such as acupuncture, acupressure, yoga, or mindfulness in dyspnea reduction.[2,14]

Mindfulness involves paying attention on purpose, in the present moment and nonreactively.[15] It has been shown to reduce stress, anxiety, depression, and improve sleep.[16–18] Although there is growing evidence to support the application of mindfulness in a variety of chronic diseases, its benefit in dyspnea reduction remains uncertain. One randomized controlled trial of an eight-week mindfulness-based intervention in COPD found no improvement in dyspnea.[19] Furthermore, it is not easy for breathless patients with lung diseases to attend conventional mindfulness interventions delivered over six to eight weeks. Therefore, we have designed a series of mini–mindfulness exercises specifically for patients with serious illnesses.[20] From these exercises, 20-minute mindful breathing was selected for this study. We aimed to examine the effect of 20-minute mindful breathing on the rapid reduction of dyspnea at rest in patients with lung diseases, particularly lung cancer, COPD, and asthma.

Methods

We conducted a parallel-group, nonblinded, randomized controlled trial at the respiratory unit at the University of Malaya Medical Centre in Malaysia from August 1, 2017, to March 31, 2018. Ethics approval was obtained from the Medical Research Ethics Committee of the University of Malaya Medical Centre (MREC no: 2017721–5421). The inclusion criteria were 1) adult inpatients with lung cancer, COPD, or asthma and 2) moderate to severe dyspnea at rest measured with the Modified Borg Dyspnea Scale (MBDS $\geq$ 3).[21] MBDS is a valid and reliable tool to measure the intensity of dyspnea.[21] It is a categorical scale with ratio properties, rating from 0 to 10, 0 being not dyspneic at all and 10 being maximally dyspneic. Patients were excluded if they were confused based on the Confusion Assessment Method, noncommunicative or uninterested.[22] Patients from the respiratory unit were approached and screened for eligibility. Those who fulfilled the criteria were recruited. Written informed consents were obtained from all participants. Sociodemographic data were obtained from participants and the medical records.

Participants were randomly assigned to the intervention group or the control group based on computer-generated random numbers. Participants allocated to the intervention group received standard care by the respiratory team plus a 20-minute mindful breathing session by one of the three trained research assistants who were also medical doctors. They were trained by the primary author, a palliative care physician who was also a certified mindfulness trainer. The training included a brief explanation of the concepts and practices of mindfulness, followed by a 20-minute mindful breathing guided by the trainer. Guidance on delivering the intervention with particular attention to paralanguage (rate, rhythm, intonation, pause, etc.) and body language (eye contact, facial expression, posture, and body movement), followed by supervising the actual delivering of the 20-minute intervention by each research assistants, was also included. During the study, the participants were instructed to relax their body, close their eyes, and focus their attention on their breathing. If they noticed any distractions, they were told to redirect their attention back to their breathing. They were interrupted once at minute 5 for outcome assessment. The instructions to conduct the 20-minute mindful breathing session are shown in Table 1. Participants in the control group received standard care alone by the respiratory team. Outcomes were assessed at minute 0 (T0), minute 5 (T5), and minute 20 (T20) by the same research assistants. The following outcomes were measured: 1) dyspnea at rest measured with MBDS, 2) oxygen saturation measured with a Nellcor Oximax N-65 pulse oximeter, and 3) respiratory rate (RR). The outcome assessment at minute 5 was performed to compare the difference between five-minute mindful breathing and 20-minute mindful breathing.

Table 1
Instructions for 20-Minute Mindful Breathing

Make yourself comfortable
Relax your body
Close your eyes gently
Take two deep breaths slowly
Then, breathe naturally
Notice the flow of air through your nose
Rest your attention gently on the breath
If you are distracted by any sounds, body sensations, thoughts, or feelings, gently come back to your breath
Be aware of the breath for the next 20 minutes

A planned sample size of 68 patients (34 per arm) was powered to detect the effect size difference between the two study arms of 1.66 standard deviation units (i.e., change of 1 on the MBDS), with a two-tailed type I error rate of 0.05 and 80% power. Because of logistic reasons, the study was terminated after 63 participants were enrolled. Data analyses were performed using SPSS (version 23.0; SPSS Inc., Chicago, IL, USA). Descriptive data were reported in percentage, mean, and median. Between-group comparisons were analyzed using a independent-samples *t*-test for parametric data, Mann-Whitney *U* test for nonparametric data, and Chi-squared test for categorical variables. All tests were two tailed with a significant level of 0.05.

Results

Of the 133 patients approached and screened, 44 had low MBDS <3, 15 were confused, and 11 declined participation. Sixty-three participants were randomly assigned to either standard care plus 20-minute mindful breathing session ($n = 32$) or standard care alone ($n = 31$). The flow of participants is illustrated in Figure 1. All 63 participants completed the study and were included in the analyses.

Table 2 shows the demographic characteristics of these participants. The mean age of the participants was 64 years. There were more male (58.7%) than female (41.3%) participants. The majority of them were ethnic Chinese (44.4%), followed by ethnic Malay

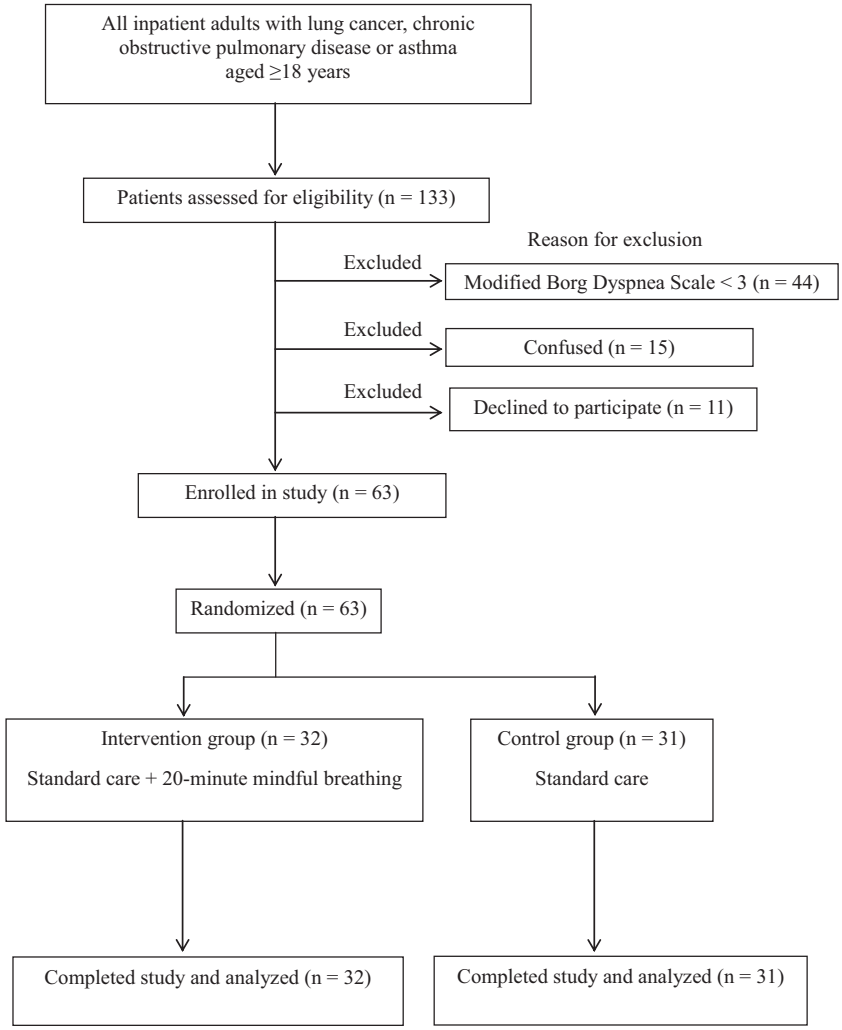

Fig. 1. Flow of participants through study protocol.

Table 2
Demographic and Clinical Characteristics of 63 Patients With Respiratory Disease

Demographic and Clinical Characteristics	Techniques: Mindful Breathing ($n = 32$)	Techniques: Control ($n = 31$)	*P*-value	Total ($n = 63$)
Age, mean ± SD (years)	64.1 ± 12.9	63.7 ± 15.5	0.929[a]	63.9 ± 14.2
Gender, *n* (%)				
Male	19 (59.4)	18 (58.1)	0.916	37 (58.7)
Female	13 (40.6)	13 (41.9)		26 (41.3)
Ethnicity, *n* (%)				
Malay	11 (34.4)	10 (32.3)	0.317	21 (33.3)
Chinese	16 (50.0)	12 (38.7)		28 (44.4)
Indian	4 (12.5)	9 (29.0)		13 (20.7)
Others	1 (3.1)	0 (0)		1 (1.6)
Religion, *n* (%)				
Islam	11 (34.4)	10 (32.3)	0.434	21 (33.3)
Buddhism	15 (46.8)	11 (35.5)		26 (41.2)
Christianity	2 (6.3)	1 (3.2)		3 (4.8)
Hinduism	4 (12.5)	7 (22.5)		11 (17.5)
Others	0 (0)	2 (6.5)		2 (3.2)
Smoking status, *n* (%)				
Ever smoker	17 (53.1)	14 (45.2)	0.527	31 (49.2)
Never smoker	15 (46.9)	17 (54.8)		32 (50.8)
Pack-years, mean ± SD	45.0 ± 28.7	50.0 ± 39.8	0.696[a]	47.3 ± 33.5
Lung disease, *n* (%)				
Lung cancer	15 (46.9)	17 (54.8)	0.808	32 (50.8)
COPD	9 (28.1)	7 (22.6)		16 (25.4)
Asthma	8 (25.0)	7 (22.6)		15 (23.8)
Hb level (g/dL), mean ± SD	12.0 ± 2.3	12.5 ± 2.2	0.431[a]	12.2 ± 2.2
Palliative referral, *n* (%)	8 (25.0)	5 (16.1)	0.384	13 (20.6)
On opioids, *n* (%)	6 (18.8)	8 (25.8)	0.321	14 (22.2)
On benzodiazepines, *n* (%)	1 (3.1)	0 (0)	1.000[b]	1 (1.6)
On supplemental oxygen, *n* (%)	17 (53.1)	13 (41.9)	0.374	30 (47.6)
On home oxygen, *n* (%)	7 (21.9)	4 (12.9)	0.348	11 (17.5)
Baseline, median (IQR)				
MBDS	3 (3)	3 (1)	0.849[c]	
Oxygen saturation	97 (3)	98 (4)	0.025[c]	
Respiratory rate	25 (10)	26 (12)	0.579[c]	

SD = standard deviation; COPD = chronic obstructive pulmonary disease; Hb = hemoglobin; IQR = interquartile range; MBDS = Modified Borg Dyspnea Scale. Other *P*-values from Chi-squared test.
[a]*P*-values from *t*-test.
[b]*P*-values from Fisher's exact test.
[c]*P*-values from Mann-Whitney *U* test.

(33.3%) and ethnic Indian (20.7%). The commonest religion was Buddhism (41.3%), followed by Islam (33.3%), Hinduism (17.5%), and Christianity (4.8%). 49.2% were smokers. 50.8% were lung cancer patients; 25.4% were COPD patients, and 23.8% were asthmatic patients. The median MBDS was 3 (moderate breathlessness) in both groups. None of the participants has long-term practice of meditation, which could confound the results.

Regarding between-group comparisons of improvement in parameters as shown in Table 3, 65.6% of participants in the mindful breathing group experienced improvement in dyspnea at T5 compared to 12.9% of participants in the control group (OR

Table 3
Between-Group Comparisons for Improvement in Parameters

Parameters	Mindful Breathing ($n = 32$)	Control ($n = 31$)	χ^2 (1, $n = 63$)	*P*-value[a]	OR (95% CI)
MBDS, *n* (%)					
T5	21 (65.6)	4 (12.9)	18.286	<0.001	12.9 (3.59–46.28)
T20	22 (68.8)	9 (29.0)	9.938	0.002	5.4 (1.83–15.79)
SaO_2, *n* (%)					
T5	12 (37.5)	4 (12.9)	5.028	0.025	4.1 (1.15–14.43)
T20	12 (37.5)	5 (16.1)	3.650	0.056	3.1 (0.94–10.31)
RR, *n* (%)					
T5	20 (62.5)	17 (54.8)	0.381	0.537	1.4 (0.50–3.75)
T20	19 (59.4)	10 (32.4)	4.661	0.031	3.1 (1.09–8.61)

OR = odds ratio; CI = confidence interval; MBDS = Modified Borg Dyspnea Scale; T5 = minute 5, T20 = minute 20; SaO_2 = oxygen saturation; RR = respiratory rate.
[a]*P*-values from Chi-squared test.

12.9; 95% CI 3.59–46.28; $\chi^2 = 18.286$; $P < 0.001$). 68.8% of participants in the mindful breathing group experienced improvement in dyspnea at T20 compared to 29.0% of participants in the control group (OR 5.4; 95% CI 1.83–15.79; $\chi^2 = 9.938$; $P = 0.002$). The number needed to treat (NNT) for mindful breathing was 1.9 at T5 and 2.5 at T20. In terms of oxygen saturation, 37.5% of participants in the mindful breathing group had improvement at T5 and T20. Compared to the control group, differences of oxygen saturation were statistically significant at T5 but not T20. For RR, 62.5% and 59.4% of participants in the mindful breathing group experienced a decrease at T5 and T20, respectively. Statistically significant difference in RR between the two groups was observed at T20.

Regarding between-group comparisons of differences in parameters as shown in Table 4, there was statistically significant reduction in dyspnea in the mindful breathing group compared with the control group both at minute 5 (U = 233.5, $n_1 = 32$, $n_2 = 31$, mean $\text{rank}_1 = 23.28$, mean $\text{rank}_2 = 37.72$, $z = -3.574$, $P < 0.001$) and minute 20 (U = 232.0, $n_1 = 32$, $n_2 = 31$, mean $\text{rank}_1 = 23.00$, mean $\text{rank}_2 = 36.77$, $z = -3.285$, $P = 0.001$). For the mindful breathing group, improvement in oxygen saturation was significant at T5, and improvement in RR was significant at T20.

For subgroup analyses, as shown in Table 5, there was significant reduction of dyspnea with mindful breathing for all three subgroups at T5. The greatest reduction of dyspnea was in the asthma subgroup (U = 5.5, $n_1 = 32$, $n_2 = 31$, mean $\text{rank}_1 = 5.19$, mean $\text{rank}_2 = 11.21$, $z = -2.775$, $P = 0.006$), followed by lung cancer (U = 78.5, $n_1 = 32$, $n_2 = 31$, mean $\text{rank}_1 = 13.23$, mean $\text{rank}_2 = 19.38$, $z = -2.044$, $P = 0.041$) and COPD (U = 15.0, $n_1 = 32$, $n_2 = 31$, mean $\text{rank}_1 = 6.67$, mean $\text{rank}_2 = 10.86$, $z = -2.126$, $P = 0.034$). There was reduction of dyspnea with mindful breathing for all three subgroups at T20, but statistical significance was observed in the asthma subgroup only (U = 4.0, $n_1 = 32$, $n_2 = 31$, mean $\text{rank}_1 = 5.00$, mean $\text{rank}_2 = 11.43$, $z = -2.939$, $P = 0.003$). For the mindful breathing group, statistically significant improvements were seen for oxygen saturation at T5 for asthma and RR at T20 in COPD patients.

Discussion

This is the first study to show the efficacy of a single session of 20-minute mindful breathing on the rapid reduction of dyspnea at rest in patients with lung cancer, COPD, and asthma. The guided practice of mindful breathing reduced dyspnea at rest at minute 5 (median reduction = −1) and minute 20 (median reduction = −2). The minimally clinically important difference for MBDS is 1 unit.[23] Hence, 20-minute mindful breathing caused a statistically and clinically significant reduction of resting dyspnea in lung diseases. Compared with the previous randomized controlled trial of eight-week mindfulness-based intervention in COPD, which failed to produce any measurable improvement in dyspnea,[19] our study showed that a single 20-minute session was beneficial.

The rapid onset of dyspnea improvement is of major clinical benefit for patients early in their disease trajectories who are not candidates for opioid therapy, such as most patients with asthma, and for patients with advanced lung diseases. The duration of the guided session is short. The practice is easy to deliver and can be delivered by any health care provider after a short training session by one of the authors. The instructions are clear and simple as in Table 1. The exercise may improve oxygen saturation and reduce RR because of its calming effect, but a larger sample size is needed to substantiate its statistical significance. At the very least, it did not produce any adverse effect on breathing.

Table 4
Between-Group Comparisons of Differences in Parameters

	Mindful Breathing		Control				
Parameters	Median (IQR)	Mean Rank	Median (IQR)	Mean Rank	U	z	*P*-value[a]
MBDS							
T5–T0	−1.0 (1.0)	23.28	0 (0)	37.72	233.5	−3.574	<0.001
T20–T0	−2.0 (2.0)	23.00	0 (1.0)	36.77	232.0	−3.285	0.001
SaO_2 (%)							
T5–T0	0 (2.0)	35.48	0 (1.0)	25.52	300.5	−2.307	0.021
T20–T0	0 (2.5)	33.26	0 (1.0)	26.85	340.5	−1.472	0.141
RR (breaths/min)							
T5–T0	−2 (6.5)	27.05	−2.0 (4.0)	33.95	346.5	−1.554	0.120
T20–T0	−2 (6.0)	24.90	0 (4.0)	34.93	287.0	−2.280	0.023

IQR = interquartile range; MBDS = Modified Borg Dyspnea Scale; T5 = minute 5; T0 = baseline; T20 = minute 20; SaO_2 = oxygen saturation; RR = respiratory rate.
[a]*P*-values from Mann-Whitney *U* test.

Table 5
Subgroup Comparisons of Differences in Parameters

	Mindful Breathing		Control				
Parameters	Median (IQR)	Mean Rank	Median (IQR)	Mean Rank	U	z	*P*-value[a]
Lung cancer							
MBDS T5−T0	−1.0 (1.0)	13.23	0 (0)	19.38	78.50	−2.044	0.041
MBDS T20−T0	−2.0 (2.0)	13.50	0 (1.5)	18.06	84.00	−1.450	0.147
SaO_2 T5−T0	0 (1.0)	19.33	0 (1.0)	14.00	85.00	−1.751	0.080
SaO_2 T20−T0	0 (2.0)	18.61	0 (1.0)	13.85	82.50	−1.554	0.120
RR T5−T0	−2.0 (8.0)	14.77	−2.0 (4.0)	18.03	101.50	−1.004	0.315
RR T20−T0	−3.0 (9.0)	13.46	0 (4.0)	18.09	83.50	−1.429	0.153
COPD							
MBDS T5−T0	0 (1.5)	6.67	0 (0)	10.86	15.00	−2.126	0.034
MBDS T20−T0	−1.0 (2.0)	6.89	0 (1.0)	10.57	17.00	−1.772	0.076
SaO_2 T5−T0	0 (2.5)	9.17	0 (1.0)	7.64	25.50	−0.681	0.496
SaO_2 T20−T0	−1.0 (5.0)	8.00	0 (1.0)	9.14	27.00	−0.485	0.627
RR T5−T0	−4.0 (7.0)	7.78	−2.0 (4.0)	9.43	25.00	−0.701	0.483
RR T20−T0	−4.0 (4.0)	6.33	2.0 (6.0)	11.29	12.00	−2.111	0.035
Asthma							
MBDS T5−T0	−1.5 (1.8)	5.19	0 (0)	11.21	5.50	−2.775	0.006
MBDS T20−T0	−2.3 (2.8)	5.00	0 (0)	11.43	4.00	−2.939	0.003
SaO_2 T5−T0	1.0 (4.5)	10.19	−1.0 (3.0)	5.50	10.50	−2.066	0.039
SaO2 T20−T0	1.0 (3.0)	9.38	−1.0 (3.0)	6.43	17.00	−1.292	0.197
RR T5−T0	−4.0 (4.8)	6.38	0 (6.0)	9.86	15.00	−1.561	0.118
RR T20−T0	−2.0 (11.8)	7.06	0 (2.0)	9.07	20.50	−0.899	0.369

IQR = interquartile range; MBDS = Modified Borg Dyspnea Scale; T5 = minute 5; T0 = baseline; T20 = minute 20; SaO_2 = oxygen saturation in %; RR = respiratory rate in breaths/min.
[a]*P*-values from Mann-Whitney *U* test.

Regarding subgroup analyses, the largest benefit was seen in the asthma group, followed by lung cancer and least in COPD. This indicated that the reversibility of dyspnea with mindful breathing was highest in asthma, followed by lung cancer and COPD. Although both asthma and COPD are chronic inflammatory airway diseases, asthma is characterized by reversible airflow obstruction, but airflow limitation in COPD is not fully reversible. Asthma affects only the airways, but COPD affects both airways and the lung parenchyma. Airway inflammation is eosinophilic and CD4-driven in asthma but is neutrophilic and CD8-driven in COPD.[24] These underlying pathophysiological differences probably affect their response to treatment. Comparing COPD and lung cancer, studies have shown that COPD is associated with worse symptoms, more fear, more physical disabilities, and poorer health-related quality of life.[25, 26]

This study has several limitations. It was a single-center study. The sample size was calculated based on adequate power analysis but was too small for subgroup analyses. It was not blinded. We did not have an active control, hence, risking performance bias. Current methods of improving dyspnea such as purse lip breathing may have been an ideal comparator. Other common lung diseases were not included, such as bronchiectasis and interstitial lung disease. Although the MBDS was chosen to minimize participants' fatigue, the outcome data could be limited by the unidimensional nature of the measurement. More insight could be gained from multidimensional measures in future research, including outcomes, such as mood, stress, and heart-rate variability. The study examined the immediate effect of a brief intervention, not the sustained effect. The willingness of these participants to actually repeat this 20-minute intervention in daily life and the degree of acceptance or satisfaction with the intervention were not explored. Suggestions for future research include 1) using a numerical rating scale or visual analog scale may capture larger differences compared with MBDS for dyspnea research, 2) the smaller benefit seen in the later phase of mindful breathing could be improved by additional instructions to anchor participants' attention, 3) multiple sessions may be needed to yield a sustained effect, and 4) a three-arm study of five-minute mindful breathing, 20-minute mindful breathing, and control may be more appropriate to validate the benefits of five-minute vs. 20-minute interventions.

Conclusion

The current results provide evidence that a single session of 20-minute mindful breathing is effective in reducing dyspnea rapidly for patients with lung cancer, COPD, and asthma. The simple act of observing the natural flow of the breath with full attention without trying to change it offers an additional option in the limited treatment modalities of dyspnea management, at no cost except that of the presence of a mindful physician.

Disclosures and Acknowledgments

The authors declared no potential conflicts of interest in respect of the research, authorship, and

publication of this article. This work was supported by the Research Acculturation Grant Scheme, Ministry of Education Malaysia (RAGS/1/2015/SKK02/UNIMAS/03/2 or FA052000−0708−0029). The authors would like to express their heartfelt gratitude to all patients who have participated in the study.

References

1. American Thoracic Society. Dyspnoea: mechanism, assessment, and management. A consensus statement. Am J Respir Crit Care Med 1999;159:321−340.

2. Parshall MB, Schwartzstein RM, Adams L, et al. An official American thoracic society statement: Update on the mechanisms, assessment, and management of dyspnoea. Am J Respir Crit Care Med 2012;185:435−452.

3. Nishino T. Dyspnoea: underlying mechanisms and treatment. Br J Anaesth 2011;106:463−474.

4. Schwartzstein RM, Simon PM, Weiss JW, et al. Breathlessness induced by dissociation between ventilation and chemical drive. Am Rev Respir Dis 1989;139:1231−1237.

5. Kathiresan G, Clement RF, Sankaranarayanan MT. Dyspnoea in lung cancer patients: a systematic review. Lung Cancer (Auckl) 2010;1:141−150.

6. Moens K, Higginson IJ, Harding R, EURO IMPACT. Are there differences in the prevalence of palliative care-related problems in people living with advanced cancer and eight non-cancer conditions? A systematic review. J Pain Symptom Manage 2014;48:660−677.

7. Refaat S, Aref H. Acute asthma in emergency department, prevalence of respiratory and non-respiratory symptoms. Egypt J Chest Dis Tuberc 2014;63:771−776.

8. Teunissen SC, Wesker W, Kruitwagen C, et al. Symptom prevalence in patients with incurable cancer: a systematic review. J Pain Symptom Manage 2007;34:94−104.

9. Guirimand F, Sahut d'izarn M, Laporte L, et al. Sequential occurrence of dyspnoea at the end of life in palliative care, according to the underlying cancer. Cancer Med 2015;4:532−539.

10. Jennings AL, Davies AN, Higgins JP, et al. A systematic review of the use of opioids in the management of dyspnoea. Thorax 2002;57:939−944.

11. Bruera E, MacEachern T, Ripamonti C, et al. Subcutaneous morphine for dyspnoea in cancer patients. Ann Intern Med 1993;119:906−907.

12. Allen S, Raut S, Woollard J, et al. Low dose diamorphine reduces breathlessness without causing a fall in oxygen saturation in elderly patients with end-stage idiopathic pulmonary fibrosis. Palliat Med 2005;19:128−130.

13. Brennan CW, Mazanec P. Dyspnoea management across the palliative care continuum. J Hosp Palliat Nurs 2011;13:130−139.

14. Galbraith S, Fagan P, Perkins P, et al. Does the use of a handheld fan improve chronic dyspnoea? A randomized, controlled, crossover trial. J Pain Symptom Manage 2010;39:831−838.

15. Kabat-Zinn J. Wherever you go, there you are: Mindfulness meditation in everyday life. New York: Hachette Books, 2009.

16. Shennan C, Payne S, Fenlon D. What is the evidence for the use of mindfulness-based interventions in cancer care? A review. Psychooncology 2011;20:681−697.

17. Ando M, Morita T, Akechi T, et al. The efficacy of mindfulness-based meditation therapy on anxiety, depression and spirituality in Japanese patients with cancer. J Palliat Med 2009;12:1091−1094.

18. Yook K, Lee SH, Ryu M, et al. Usefulness of mindfulness-based cognitive therapy for treating insomnia in patients with anxiety disorders: a pilot study. J Nerv Ment Dis 2008;196:501−503.

19. Mularski RA, Munias BA, Lorenz KA, et al. Randomized controlled trial of mindfulness-based therapy for dyspnoea in chronic obstructive lung disease. J Altern Complement Med 2009;15:1083−1890.

20. Beng TS. The little handbook of mini-mindfulness meditation. Pittsburgh, CA: Dorrance, 2012.

21. Kendrick KR, Baxi SC, Smith RM. Usefulness of the modified 0-10 Borg scale in assessing the degree of dyspnoea in patients with COPD and asthma. J Emerg Nurs 2000;26:216−222.

22. Inouye SK, van Dyck CH, Alessi CA, et al. Clarifying confusion: the confusion assessment method. A New method for detection of delirium. Ann Intern Med 1990;113:941−948.

23. Ries AL. Minimally clinically important difference for the UCSD Shortness of breath Questionnaire, Borg scale, and visual analog scale. COPD 2005;2:105−110.

24. Buist AS. Similarities and differences between asthma and chronic obstructive pulmonary disease: treatment and early outcomes. Eur Respir J Suppl 2003;39:30s−35s.

25. Gysels MH, Higginson IJ. The lived experience of breathlessness and its implications for care: a qualitative comparison in cancer, COPD, heart failure and MND. BMC Palliat Care 2011;10:15.

26. Habraken JM, ter Riet G, Gore JM, et al. Health-related quality of life in end-stage COPD and lung cancer patients. J Pain Symptom Manage 2009;37:973−981.