Original paper

Iwona Damps-Konstanska[1], Małgorzata Krajnik[2], Beata Wajda[1], Aleksandra Modlińska[3], Ewa Jassem[1]

[1]Department of Allergology, Chair of Lung Disease, Medical University of Gdansk, Poland
[2]Palliative Care Department, Nicolas Copernicus University, Collegium Medicum in Bydgoszcz, Poland
[3]Palliative Care Department, Chair of Family Medicine, Medical University of Gdansk, Poland

Reading numbers aloud as a tool for the evaluation of breathlessness in Polish cancer patients

Abstract

Background: The aim of the study was to verify the usefulness of the test of reading numbers aloud (ReNA) in the assessment of the intensity of dyspnoea at rest or on minimal exertion in Polish patients with advanced cancer.

Material and methods: The study group included patients with advanced cancer who were breathless at rest or on minimal exertion. A modified Borg scale, a numeric rating scale (NRS) and a visual analogue scale (VAS) to assess breathlessness and peak expiratory flow (PEF) were performed. Patients then read aloud from a page containing a grid of numbers as quickly and clearly as they could for 60 seconds. It was intended to repeat the reading five times. The maximal amount of numbers read during the test (NNmax) and the maximal numbers read per breath (NN/Bmax) were noted.

Results: Thirty-one patients with evidence of cancer participated in the study. However, for statistical analysis we included 28 patients (17 males, mean age 64.1 ± SD = 8.8) who were able to read numbers aloud at least once. The mean value for the modified Borg scale was 4.07 ± 1.89, NRS 5.75 ± 2.37 and VAS 5.11 ± 2.34. The average value for PEF was 183.26 ± 89.97. Twelve patients (42.86%) were unable to complete all five readings due to tiredness and fatigue. The mean value for the NNmax was 50.39 ± 29.93 and for NN/Bmax was 2.92 ± 2.45. No correlation was observed between the results for NRS, VAS or PEF and NNmax or NN/Bmax. Only the modified Borg scale correlated moderately with NNmax and NN/Bmax (R = –0.52 and R = –0.44, respectively).

Conclusion: The ReNA seems to be a useful tool for assessing the intensity of dyspnoea at rest or on minimal exertion in Polish patients with advanced cancer. However, fatigue and tiredness due to the reading were a problem for almost half of the advanced cancer patients, who were unable to complete the whole test.

Key words: breathlessness, cancer, reading numbers aloud

Adv. Pall. Med. 2010; 9, 3: 73–80

Address for correspondence: Iwona Damps-Konstanska
Department of Allergology, Chair of Lung Disease, Medical University of Gdansk
ul. Dębinki 7, 80–211 Gdansk, Poland
Tel/fax: (+48 58) 349 16 25
e-mail: damik@gumed.edu.pl

Advances in Palliative Medicine 2010, 9, 73–80

Introduction

Breathlessness is a common symptom in many chronic illnesses, including both malignant and non-malignant conditions. In cancer it may be caused by the tumour itself, oncological treatment, complications of the debilitated state or concomitant disease. The incidence of breathlessness is especially high during the last six weeks of life and assessed in different studies as between 50–70% [1]. Management of dyspnoea is aimed first at reversing the underlying cause; however, if this is not possible or not satisfactorily effective, symptomatic treatment might be required. This usually consists of non-pharmacological and pharmacological methods, such as opioids, anxiolytics, bronchodilators or corticosteroids [2]. Their efficacy in cancer patients is assessed by subjective measures, although it is still unclear which objective parameters might be helpful. In patients who are breathless on exertion, the Six-Minute Walk Test or Shuttle Walking is usually used as a tool for objective evaluation [3, 4]. However, this cannot be implemented in many advanced cancer patients, who are too weak to march or who are short of breath at rest or on minimum exertion. For this population, Wilcock et al. proposed reading numbers aloud (ReNA) for measuring the limiting effect of breathlessness [5]. Our pilot study, described in this paper, was presented first during the 19th Annual Congress of the European Respiratory Society in Vienna in 2009 [6]. We aimed to verify the usefulness of ReNA in the assessment of the intensity of dyspnoea at rest or on minimal exertion in Polish patients with advanced cancer. We also investigated the relation of ReNA to the chosen screening spirometric parameter and to some subjective measurement scales.

Methodology

The study was approved by the Ethical Committee of the Medical University of Gdansk. The patients included in the study were treated either in the Lung Disease Department of the University Hospital in Gdansk or in the Hospice Pallotinum in Gdansk. The patients suffered from cancer and were breathless at rest or on minimal exertion. All participants gave written informed consent. The study duration per patient was one day. Patients were asked to rate the severity of breathlessness by using a Numerical Rating Scale (ranging from 0 = "no breathlessness" to 10 = "breathlessness as bad as you can imagine"), a continuous Visual Analogue Scale (0–100 mm), and a modified Borg Scale [7]. The last scale consists of a vertical scale labelled from 0 to 10 with a corresponding verbal expression of increasing perceived sensation intensity, from "nothing at all" to "maximal" [7]. Apart from subjective measures, a measurement of peak expiratory flow (PEF) was performed with the subjects, standing as the best of three recordings (Mini-Wright Peak Flow Meter, Clement Clarke International UK).

While seated, the patients read numbers aloud (ReNA) from a page containing a grid of numbers as quickly and clearly as they could for 60 seconds. The amount of numbers read during the test and the numbers read per breath were noted. It was intended to repeat the reading five times to choose the maximum values.

Results

Thirty-one patients (18 males, mean age 63.6 ± SD = 7.78) with evidence of cancer participated in the study (Table 1). In one case we included two sets of measurement results as the patient was referred to the Lung Disease Department twice (as patient no. 2 in June 2007 and as patient no. 11 in December 2007). Twenty-nine patients were diagnosed as having primary or secondary lung tumours, the other two had breast cancer. Seven patients also had obstructive airways disease. All complained of breathlessness that limited their daily activities. None was limited by dysarthria or cognitive impairment.

The concept of the reading numbers aloud test was easily understood by all participants.

Four patients (nos. 9, 12, 18 and 25 in Table 1) were unable to do any reading at all due to severe weakness. All four assessed their breathlessness according to the modified Borg, NRS and VAS scales; two of them (nos. 9 and 12) were also able to perform a PEF measurement. However, for statistical analysis we included only 28 patients (17 males, mean age 64.1 ± SD = 8.8) who were able to read numbers aloud at least once. One patient from this group (no. 4 in Table 1) did not perform a PEF due to the unexpected breakdown of the equipment.

The mean value for the modified Borg scale in the study group (n = 28) was 4.07 ± 1.89; NRS 5.75 ± 2.37; and VAS 5.11 ± 2.34 (Table 2). The average value for PEF (n = 27) was 183.26 ± 89.97.

Twelve patients (42.86%) were unable to complete all five readings due to tiredness and fatigue. Two patients had already stopped after the first, another after the second reading. Eight others resigned from ReNA after the third reading, the other patient after the fourth.

Table 1. Characteristics of all patients included in the study

Pt	Diagnosis	Age	NRS	Borg	VAS	PEF	NN max	NN1	NN2	NN3	NN4	NN5	NN/B max	NN/B1	NN/B2	NN/B3	NN/B4	NN/B5
1	Lung cancer + asthma	59	4	2	4	105	45	45	0	0	0	0	2.6	2.6	0	0	0	0
2	Lung cancer + hydrothorax	65	3	3	7.1	133	57	57	56	55	57	54	4.8	4.8	2.9	2.9	2.9	2.6
3	Cervical cancer + lung metastases + pneumothorax	64	9	7	6.5	100	24	14	24	19	0	0	2.2	0.9	2.2	1.6	0	0
4	Breast cancer	74	8	5	7.2	-	26	26	20	22	22	23	1.1	1.1	0.9	1.0	0.8	0.9
5	Lung cancer	67	10	10	10	70	24	24	20	18	22	20	1.0	1.0	1.0	0.9	0.8	0.8
6	Lung cancer	62	6	4	4.7	100	59	36	39	59	0	0	4.2	1.9	2.3	4.2	0	0
7	Cancer of Vater's papilla + lung metastases	53	8	5	7.3	120	36	36	19	24	34	0	2.4	2.4	1	1.3	1.9	0
8	Lung cancer	80	7	5	6.6	100	24	23	23	24	0	0	1.2	1.2	1.2	1.0	0	0
9	Lung cancer	48	0	0	0.2	60	0	0	0	0	0	0	0	0	0	0	0	0
10	Lung cancer	52	5	7	4.8	150	24	24	0	0	0	0	1	1	0	0	0	0
11	Lung cancer + COPD	65	4	3	1.8	170	59	59	59	58	58	60	3.0	3.0	2.5	2.6	2.6	3.5
12	Lung cancer + COPD	60	10	4	8.2	200	0	0	0	0	0	0	0	0	0	0	0	0
13	Lung cancer + COPD	73	6	4	5.8	230	64	64	61	60	64	53	3.6	3.0	2.7	3.2	3.6	2.7
14	Lung cancer	50	6	4	4.8	220	52	45	47	51	52	56	3.3	2.6	2.4	2.8	2.6	3.3
15	Lung cancer	61	5	4	8.2	190	44	44	43	40	0	0	1.9	1.9	1.6	1.7	0	0
16	Lung cancer + pneumonia	62	7	5	5.7	320	38	38	37	34	33	32	1.3	1.1	1.3	1.1	1.0	1

→

Table 1. Characteristics of all patients included in the study — continuation

Pt	Diagnosis	Age	NRS	Borg	VAS	PEF	NN max	NN1	NN2	NN3	NN4	NN5	NN/B max	NN/B1	NN/B2	NN/B3	NN/B4	NN/B5
17	Lung cancer + status post-pneumonectomy	61	4	2	3	210	135	86	101	135	109	107	9.9	7.8	5.6	9.6	9.9	9.7
18	Lung cancer + pneumohydrothorax	49	4	3	2.6	0	0	0	0	0	0	0	0	0	0	0	0	0
19	Lung cancer + hydrothorax	64	5	4	4.2	150	40	33	30	31	37	40	3.3	1.4	1.3	2.8	3.3	1.5
20	Breast cancer + pneumothorax	66	1	2	0.4	130	46	40	40	41	46	41	2.6	2.1	1.9	1.9	2.2	2.6
21	Lung cancer	66	1	1	1.6	140	85	75	82	84	85	80	4.5	4.2	4.3	4.4	4.5	4.4
22	Lung cancer + COPD	69	5	2	0.6	350	40	40	40	36	0	0	1.5	1.5	1.5	1.3	0	0
23	Colonic cancer + lung metastases	78	8	4	5.7	250	11	11	10	0	0	0	0.5	0.5	0.3	0	0	0
24	Lung cancer + COPD	51	6	4	4.5	380	43	35	37	40	41	43	2.4	2.1	1.8	1.9	2.2	2.4
25	Lung cancer	85	7	4	8.3	0	0	0	0	0	0	0	0	0	0	0	0	0
26	Laryngeal cancer + lung metastases	60	8	5	8	110	26	26	25	18	0	0	1.1	0.8	1.1	0.4	0	0
27	Lung cancer + status post-pneumonectomy	52	3	2	3.2	160	60	60	54	46	0	0	3	3	1.9	1.7	0	0
28	Lung cancer + COPD	82	8	6	8	90	44	38	40	44	41	44	1.2	1.2	1.1	1.2	1.1	1.0
29	Lung cancer	67	4	4	3.8	210	61	54	52	52	61	44	2.5	2.3	2.5	2.4	2.3	1.8
30	Lung cancer + hydrothorax	70	5	4	6	160	52	40	47	52	0	0	2.5	2	2.5	2.3	0	0
31	Disseminated cancer	51	10	3	5.1	400	145	113	115	145	64	75	11.3	11.3	6.7	10.4	4.6	4.9
32	Lung cancer	70	5	3	4.6	200	47	43	46	46	45	47	2.0	2.0	1.9	2	1.9	2.0

COPD — chronic obstructive pulmonary disease; NN — amount of numbers read; NNmax — maximal amount of numbers read; NN/B — amount of numbers read per breath; NN/Bmax — maximal amount of numbers read per breath

Table 2. Results of the ReNA test

	n	Mean	Minimum	Maximum	SD
Age	28	64.07	50.0	82.0	8.80
NRS	28	5.75	1.0	10.0	2.37
Borg	28	4.07	1.0	10.0	1.89
VAS	28	5.11	3.4	10.0	2.34
PEF	27	183.26	70.0	400.0	89.97
NNmax	28	50.39	11.0	145.0	29.93
NN1	28	43.89	11.0	113.0	21.91
NN2	26	44.88	10	115	24.54
NN3	25	49.36	18	145	31.6
NN4	17	51.23	22	109	22.07
NN5	16	51.18	20	107	21.87
NN/Bmax	28	2.92	0.5	11.3	2.45
NN/B1	28	2.52	0.5	11.3	2.27
NN/B2	26	2.16	0.26	6.7	1.44
NN/B3	25	2.66	0.43	10.35	2.41
NN/B4	17	2.83	0.81	9.9	2.14
NN/B5	16	2.82	0.76	9.72	2.21

SD — standard deviation

Table 3. Correlations between NRS, Borg scale, VAS or PEF and the maximal amount of numbers and amount of numbers per breath

	NRS (n = 28)	VAS (n = 28)	Borg (n = 28)	PEF (n = 27)
NNmax	–0.21	–0.35	–0.52*	0.02
NN/Bmax	–0.1	–0.27	–0.44*	–0.02

The mean value for the maximum amount of numbers read over 60 seconds (NNmax) was 50.39 ± 29.93 and for the maximum amount of numbers read per breath (NN/Bmax) was 2.92 ± 2.45 (Table 2).

No learning effect was observed and the mean values for NN and NN/B for all five readings did not differ significantly (Table 2; Figures 1 and 2).

No correlation was observed between the results for NRS, VAS or PEF and NNmax or NN/Bmax (Table 3). Only the modified Borg scale correlated moderately with NNmax and NN/Bmax ($R = –0.52$ and $R = –0.44$, respectively; $p < 0.05$; Spearman correlation test).

Discussion

In this pilot study we assessed the use of ReNA to measure the limiting effect of breathlessness in Polish advanced cancer patients who were breathless at rest or on minimal exertion. The concept of ReNA was easily understood and simple to perform for the study participants. Contrary to Wilcock et al. [5], we did not observe a learning effect with an increase in NN and NN/B over the five readings and the first reading did not differ from the second or third. Instead, we noticed a clear "fatigue effect". Indeed, severe fatigue and tiredness due to the reading was the main reason why almost 43% of the patients were unable to complete the test. We cannot exclude the possibility that in some patients with advanced cancer, dyspnoea may be a clinical expression of the syndrome of overwhelming fatigue that is highly prevalent in this population.

Neither NRS nor VAS was related to the mean values of NNmax and NN/Bmax. The striking observation was that some patients assessed the severity of their breathlessness as very low according to VAS or NRS, but were not able to finish even the first read-

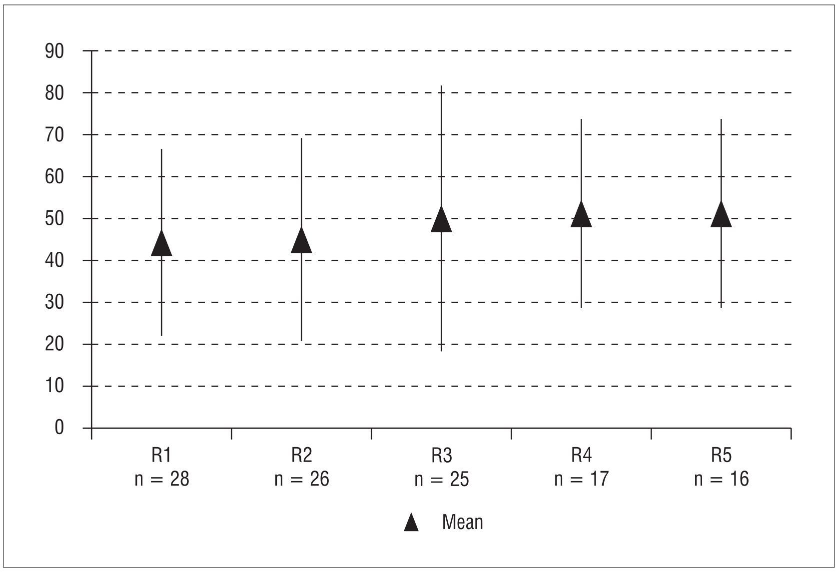

Figure 1. Mean amount of numbers (± SD) read by the patients. R — reading; n — number of patients

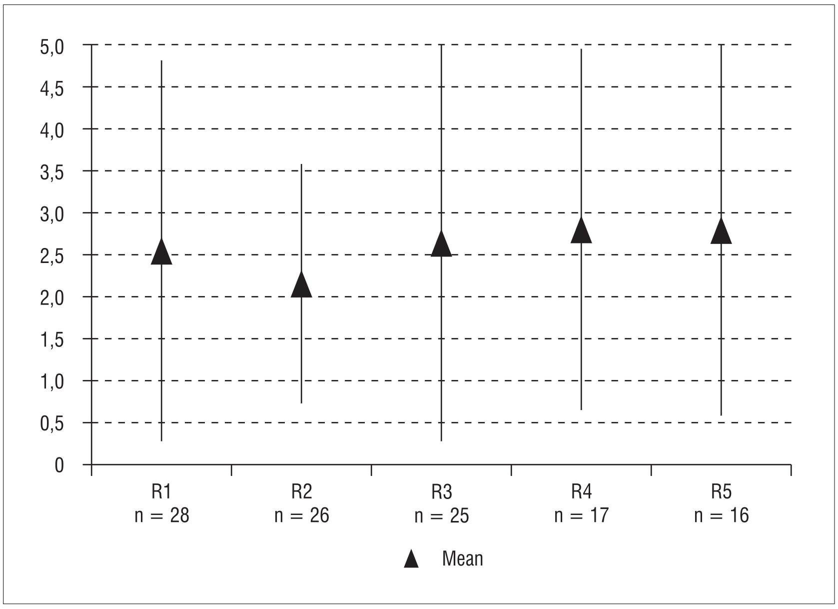

Figure 2. Mean amount of numbers read per breath (± SD) by the patients. R — reading; n — number of patients

ing, as they became extremely exhausted or could not catch a breath (see Table 1, f.ex. patient no. 9 or 18). Among the tests for the subjective evaluation of breathlessness intensity that we used, only the modified Borg scale correlated moderately with ReNA parameters. The Borg Scale was thought to be more convenient for interindividual comparisons because of the established categories, while VAS or NRS allow each subject to establish their own interval assessment.

The mean NNmax and NN/Bmax did not correlate with PEF. It has been shown previously that spirometry cannot be a reliable guide to a subjective level of breathlessness as measured by VAS in advanced cancer patients [8]. Interestingly, spirometry was shown to be less closely correlated with exercise tolerance in patients with chronic bronchitis than measures of psychological factors [9]. Dyspnoea is a complex syndrome and different studies have pointed to the need for the proper assessment of related bio-psycho-social-spiritual factors and the comprehensive management of breathlessness [10].

If different tools evaluate different aspects of dyspnoea, then we should methodically select the most appropriate scale for measuring breathlessness depending on the context and purpose. The NRS, VAS or modified Borg scale seem the most suitable for measuring how patients assess the severity of breathlessness. However, some basic questions to be answered are whether the breathlessness might be measured at rest or on exertion and how this exertion which makes a patient breathless can be defined. There is a need to develop a standardized test of the impact of breathlessness on functional capacity in advanced cancer patients. The Shuttle Walking Test has proved to be a reproducible method of evaluating such an effect in mobile patients whose clinical condition is stable [4]. However, it cannot be implemented in patients too frail to walk or who are breathless on minimal exertion, such as talking. For patients with cancer of WHO performance status 3 or 4, two other tests should probably be selected: upper limb exercise [11] and ReNA [5]. The latter might be seen as a form of exercise test for measuring the limiting effect of breathlessness if patients are breathless on minimum exertion or at rest.

In conclusion, we have shown that the measurement of the amount of numbers read over 60 seconds and the amount of numbers per breath was easily understood by Polish patients, practical and highly acceptable. However, fatigue and tiredness due to the reading were a problem for almost half of the advanced cancer patients, who were unable to complete the whole test.

Future study should assess the reproducibility and sensitivity of ReNA for Polish cancer patients.

References

1. Reuben D.B., Mor V. Dyspnea in terminally ill cancer patients. Chest 1986; 89: 234–236.
2. Thomas J.R., von Gunten C.F. Dyspnea. In: Bruera E., Higginson I.J., Ripamonti C., von Gunten C.F. (eds.). Textbook of Palliative Medicine. Hodder Arnold, London 2009: 655–662.
3. ATS Statement: Guidelines for the six-minute walk test. Am. J. Respir. Crit. Care Med. 2002; 166: 111–117.
4. Booth S., Adams L. The shuttle walking test: a reproducible method for evaluating the impact of shortness of breath on functional capacity in patients with advanced cancer. Thorax 2001; 56: 146–150.
5. Wilcock A., Crosby V., Clarke D., Corcoran R., Tattersfield A. Reading numbers aloud: a measure of the limiting effect of breathlessness in patients with cancer. Thorax 1999; 54: 1099–1103.
6. Damps-Konstańska I., Krajnik M., Wajda B., Modlińska A., Krakowiak P., Jassem E. Reading numbers loudly — evaluation of breathlessness at rest in Polish patients with cancer. Eur. Respir. J. 2009; 34 (Suppl. 53): 469 (19th ERS Annual Congress. Vienna, Austria, 12–16 IX 2009. Abstracts).
7. Dorman S., Byrne A., Edwards A. Which measurement scales should we use to measure breathlessness in palliative care? A systematic review. Palliat. Med. 2007; 21: 177–191.
8. Heyse-Moore L., Beynon T., Ross V. Does spirometry predict dyspnoea in advanced cancer? Palliat. Med. 2000; 14: 189–195.
9. Morgan A.D., Peck D.F., Buchanan D.R., McHardy G.J.R. Effects of attitudes and beliefs on exercise tolerance in chronic bronchitis. Br. Med. J. 1983; 286: 171–173.
10. Chiu T.Y., Hu W.Y., Lue B.H., Yao C.A., Chen C.Y., Wakai S. Dyspnea and its correlated in Taiwanese patients with terminal cancer. J .Pain Symptom Manage. 2004; 28: 123–132.
11. Wilcock A., Walker G., Manderson C. et al. Use of upper limb exercise to assess breathlessness in patients with cancer: tolerability, repeatability, and sensitivity. J. Pain Symptom Manage. 2005; 29: 559–564.