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Psychosocial effects of continuous oxygen therapy in hypoxaemic chronic obstructive pulmonary disease patients

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Psychosocial effects of continuous oxygen therapy in hypoxaemic chronic obstructive pulmonary disease patients. A. Lahdensuo, M. Ojanen, A. Ahonen, J. Laitinen, H. Poppius, Y. Salorinne, R. Tammivaara, P. Tukiainen, K.Venho, V. Vilkka.
ABSTRACT: Twenty six hypoxaemic patients with severe and stable chronic obstructive pulmonary disease (COPD) were treated with continuous domiciliary oxygen for a six month period. The patients were evaluated 1, 3 and 6 months after the start of oxygen therapy. In addition to blood gas analysis, 15 coping skills were evaluated by the patient and by the nurse, who also rated the general activity of the patients. Depression was measured by Beck Depression Inventory (BDI) at the start of the trial and after six months' oxygen therapy. The general psychosocial response was meagre; no significant changes were observed in any psychosocial measures. The response was slightly better in younger and less hypoxaemic patients. We conclude that the psychosocial response to oxygen therapy in severely hypoxaemic COPD patients is limited. *Eur Respir J., 1989, 2, 977–980.*

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Since the reports of the British Medical Research Council Working Party (BMRC) [1] and the Nocturnal Oxygen Therapy Trial Group (NOTT) [2] described a fall in the chronic obstructive pulmonary disease (COPD) mortality during continuous oxygen therapy, this treatment has been increasingly popular. Although COPD patients have considerable psychosocial problems [3–6] few studies have been carried out that measure the life quality effects of oxygen therapy. The aim of our study was to investigate the psychosocial effects of oxygen therapy in hypoxaemic COPD patients.

Patients and methods

Our criteria for continuous oxygen therapy were:1) severe COPD; 2) no smoking during three months; 3) arterial oxygen tension (Pao_2) <55 mmHg or Pao_2 55–59 mmHg and one of the following: haematocrit >55, cor pulmonale in electrocardiogram (ECG) or history of at least one attack of acute cardiac failure due to cor pulmonale. The blood gas analysis had to be taken twice with an interval of at least three weeks to confirm the stability of the disease.

Twenty six patients, mean age 63 yrs, (range 45–75 yrs), 7 females and 19 males, fulfilled the above criteria. The medical treatment of these patients consisted of stable bronchodilatatory therapy and diuretics and digitalis. No psychotropic drugs were used. Oxygen was administered for these patients using oxygen concentrators and nasal cannulae with a flow which increased their Pao_2 values above 8.0 kPa (60 mmHg) and the increase had to be at least 0.8 kPa (6 mmHg). Patients were required to use oxygen therapy 24 h a day for six months.

Table1. – Coping skills. The list of specific skills and their means at the initial measurement (patient ratings, n =26)

1.	Eating	1.6
2.	Getting out of the bed	1.7
3.	Going to the toilet	1.8
4.	Dressing	2.5
5.	Light, hobby-like, work	2.7
6.	Walking a short distance (10 – 20 m)	2.7
7.	Going down stairs	2.8
8.	Washing	3.1
9.	Longer standing	3.3
10.	Preparing food	3.7
11.	Squatting and bending down	3.8
12.	Lifting and carrying things	3.9
13.	Going up stairs	4.1
14.	House cleaning	4.3
15.	Walking long distance (over 500 m)	4.5

The scale:
1 = No problems.
2 = Some problems; I do not manage as fast or as easily as before, but I cope quite well.
3 = Quite a lot problems; I manage without help, but not easily.
4 = A lot of problems; I need help, I manage alone only with great difficulties.
5 = Very difficult; I do not manage alone.

The patients were evaluated in hospital 1, 3 and 6 months after the start of oxygen therapy. In addition to blood gas analysis, several psychosocial evaluations were performed during these visits. Fifteen coping skills (table 1) were evaluated by the patient (5 point scale) and by the nurse (10 point scale, increasing numbers - increasing difficulties), and the general activity and independence of the patients was evaluated using a 10 point visual analogue scale. Depression was measured by the Beck Depression Inventory (BDI) [7] at the start of the trial and after six months' oxygen therapy. The internal consistency reliabilities (Cronbach's Alpha) of initial measurement were as follows: BDI 0.82, coping skills (patient) 0.88, coping skills (nurse) 0.92. The mean correlation of patient and nurse coping skills was 0.77 at four measuring points.

Student's paired t-test and two-factor analysis of variance with repeated measures were used for the statistical analysis. The study design was approved by the local Medical Ethics Committee.

Results

Before oxygen therapy the patients suffered from considerable hypoxaemia and their mean arterial carbon dioxide tension ($Paco_2$) values were at the upper limit of the values generally regarded as normal (table 2). The general psychosocial response to oxygen therapy was not pronounced in our patients despite their good oxygenation response. Although the trend was positive in all variables, no significant improvement was observed. The best treatment effect was seen in depression ($p<0.06$), (table 3).

Table 2. – The results (means and SD) of arterial blood gas analysis during the trial in 26 patients with severe COPD

	Ambient air		Low-flow oxygen					
Time months	0		1		3		6	
	kPa	mmHg	kPa	mmHg	kPa	mmHg	kPa	mmHg
Pao_2	6.5 (0.9)	48.3 (7.5)	8.6 (1.2)	64.1 (9.1)	8.5 (1.3)	63.9 (9.6)	8.4 (1.5)	63.2 (10.9)
$Paco_2$	6.1 (1.8)	45.3 (13.3)	6.1 (1.7)	46.0 (12.4)	6.5 (1.7)	48.7 (13.0)	6.5 (2.0)	48.6 (15.1)
pH	7.42 (0.1)		7.41 (0.1)		7.40 (0.1)		7.40 (0.1)	
BE mmol·l^{-1}	4.4 (4.4)		3.7 (4.1)		4.1 (4.3)		4.2 (4.2)	

COPD: chronic obstructive pulmonary disease; Pao_2: arterial oxygen tension; $Paco_2$: arterial carbon dioxide tension; BE: base excess.

Table 3. – Psychosocial response (mean and SD) in 26 patients with severe COPD during 6 months' domiciliary oxygen therapy

	months			
	0	1	3	6
General activity and independence [1]	5.4 (1.4)	5.5 (1.6)	5.5 (1.9)	5.9 (2.1)
Depression[2] (BDI)	18.2 (9.3)	-	-	15.1* (9.6)
Coping skills [2] (patient)	45.8 (9.5)	44.6 (11.3)	42.3 (12.7)	42.8 (12.6)
Coping skills [2] (nurse)	85.6 (24.6)	82.0 (25.5)	83.1 (27.6)	83.4 (24.3)

* : $p<0.06$; [1]: increasing values = improvement; [2]: decreasing values = improvement; COPD: chronic obstructive pulmonary disease; BDI: Beck Depression Inventory.

In order to find out whether any subgroups responded differently to oxygen therapy, we divided our patients according to their initial mean Pao_2 values and ages into two groups of equal size. In patients with poor initial Pao_2 values the psychosocial response to oxygen therapy was nil. In patients with a better initial Pao_2 level a significant response ($p<0.05$) was observed in both patient and nurse evaluated coping skills and the response in depression approached statistical significance ($p<0.07$). Similarly, patients above 64 yrs of age showed no psychosocial response, but patients below 64 yrs responded significantly in depression ($p<0.03$).

Two-factor analysis of variance with repeated measures confirmed the small treatment effects on psychosocial variables. Of the interaction effects only that of time and Pao_2 values on coping skills evaluated by the nurse was statistically significant ($p<0.01$). The paired t-test compares only the initial and final measures, but analysis of variance uses data on all measurement points. Also the interaction effect is "pure" and does not contain any main effects as in paired t-test.

The association of psychosocial and blood gas analysis measures (Pao_2 and $Paco_2$) was also examined. The correlations were practically zero (0.00–0.26). The psychosocial condition of patients could not be predicted by blood gas measures.

Discussion

The COPD patients suffered from considerable depression by the BDI. The normal range in BDI is 0–10 points [7]. We studied a group of 70 patients who had suffered from tuberculosis and found that their mean BDI was 12.3 (unpublished observation). In a Finnish sample of 299 patients with coronary heart disease, the mean BDI was 13.0 [8]. Thus, the initial level of depression observed in our COPD patients was high (BDI=18.2), and depression was especially high (20.4) in older COPD patients. Depression involved mainly fatigue, weakness and exhaustion, but guilt feelings and suicidal thoughts were approaching the normal level. Similarly in NOTT patients 42% showed evidence of depression [6].

Marked problems were also seen in coping skills: only half of our patients were able to clean their homes by themselves and could walk more than 500 m. If we suppose the skills described in table 1 can be successfully performed by healthy 63 yr old persons, we can estimate that the performance level is about 53% of the maximum 100% (this can be estimated by transforming the obtained coping skill values to range from 0 to 100). Our tuberculosis group had a value of 90% by the same method. This comparison clearly shows that the problems of daily life were great in our oxygen group.

When planning our study we realized the need for a control group. Unfortunately we were not able to use one, because according to Finnish ethical standards it is not possible to withhold oxygen therapy for a six month period in severely hypoxaemic COPD patients. On the other hand, in our unpublished observations on pulmonary rehabilitation we have noticed that the psychosocial state in severe COPD patients is stable and does not change despite close follow-up observations.

The general psychosocial response to oxygen therapy was quite weak in our patients. This is in agreement with the findings of HEATON *et al.* [9] in NOTT patients. Although oxygen therapy can improve some neuropsychological functions [10, 11] psychosocial responsiveness seems to be limited in COPD patients. The response was slightly better in the less severely hypoxaemic and younger patients. Severely hypoxaemic and elderly COPD patients have probably adopted a very cautious and passive life-style which does not change easily, despite the improved physiological state achieved with oxygen therapy. PEDINIELLI *et al.* [12] have shown that the psychological impact of COPD originates not only from the hypoxaemia itself but also from the hypoxaemia-related physical impairment and from other factors such as age and forced expiratory volume in one second (FEV_1). Oxygen concentrators keep our patients closely bound to their homes. It is possible that portable liquid oxygen therapy would allow a better psychosocial response.

Could the variations in treatment compliance explain the different treatment effects in subgroups? Although there was a general trend towards diminishing treatment compliance in all of our patients (the mean daily concentrator usage 20.6 h in one month, 17.2 h in 3 months and 16 h in 6 months) the only significant difference in our subgroups was in one month: patients with more severe hypoxaemia used their concentrators more (22.3 h daily) than patients with less severe hypoxaemia (19.1 h daily, $p<0.01$). Thus, the differences in treatment compliance do not provide an explanation for our results, neither do differences in oxygen response in different groups.

The type of psychosocial measures (ratings) may also emphasize the stability of patient behaviour. When PAUL and LENTZ [13] executed their successful study on the rehabilitation of long-term schizophrenic patients, they found that ratings measure the general psychosocial level of patients very well, but that these measures are not very sensitive to change. They showed that time sampled behavioural observations reflected patient changes more sensitively than ratings. However, time sampling is a very expensive method, and is not practical in domestic situations. There was a simple question in the oxygen study which shows that the effects of oxygen therapy may be more positive than the ratings indicate: the patients were asked if they dared to go out. At 1, 3 and 6 months follow-up the number of patients who ventured out was 13, 14 and 18.

Although we know from previous studies that the survival of very hypoxaemic COPD patients can be improved with oxygen therapy, our ability to improve their psychosocial state with this therapy is limited. When goals are set for oxygen therapy in a particular patient the initial state (*e.g.* level of hypoxaemia, age) must be taken into account.

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References

1. British Medical Research Council Working Party (BMRC) – Long term domiciliary oxygen therapy in chronic hypoxemic cor pulmonale complicating chronic bronchitis and emphysema. *Lancet*, 1981, i, 681–686.
2. Nocturnal Oxygen Therapy Trial Group (NOTT) – Continuous or nocturnal oxygen therapy in hypoxemic chronic obstructive lung disease: a clinical trial. *Ann Intern Med*, 1980, 93, 391–398.
3. Agle DP, Baum GL. – Psychological aspects of chronic obstructive pulmonary disease. *Med Clin North Am*, 1977, 61, 749–758.
4. Lester DM. – The psychological impact of chronic obstructive pulmonary disease. *In*: Pulmonary Care. R.F. Johnson ed., Grune & Stratton, New York, 1973, pp. 341–354.
5. Dudley DL, Glaser EM, Jorgenson BN, Logan DL. – Psychosocial concomitants to rehabilitation in chronic obstructive pulmonary disease. Part 1: Psychosocial and psychological considerations. *Chest*, 1980, 77, 413–420.
6. McSweeny AJ, Grant I, Heaton RK, Adams KM, Timms RM. – Life quality of patients with chronic obstructive pulmonary disease. *Arch Intern Med*, 1982, 142, 473–478.
7. Beck AT, Steer RA, Garbin MG. – Psychometric properties

of the Beck Depression Inventory: twenty five years of evaluation. *Clin Psychol Rev*, 1988, 8, 77–100.
8. Raitasalo R. – Depression and its connections with the need for psychotherapy. Kansaneläkelaitoksen julkaisuja, Helsinki, 1977, A:13.
9. Heaton RK, Grant I, McSweeny AJ, Adams KM, Petty TL, NOTT Study group. – Psychological effects of continuous and nocturnal oxygen therapy in hypoxemic chronic obstructive pulmonary disease. *Arch Intern Med*, 1983, 143, 1941–1947.
10. Krop HD, Block AJ, Cohen E. – Neuropsychologic effects of continuous oxygen therapy in chronic obstructive pulmonary disease. *Chest*, 1973, 64, 317–322.
11. Block AJ. – Neuropsychological effects of long term oxygen therapy. *Eur J Respir Dis*, 1986, 146 (Suppl.), 417–419.
12. Pedinielli JL, Campoli C, Betermiez P, Aubry P. – Relationships between physical impairment, psychologic disorders and blood gas anomalies in chronic respiratory failure. *Sem Hop Paris*, 1987, 63, 3089–3093.
13. Paul GL, Lentz RJ. – *In*: Psychosocial treatment of chronic mental patients. Milieu *versus* social-learning programs. Harvard University Press, Cambridge, Mass., 1977.

Effets psychosociaux d'une oxygénothérapie continue dans les bronchopneumopathies chroniques obstructives. A. Lahdensuo, M. Ojanen, A. Ahonen, J. Laitinen, H. Poppius, Y. Salorinne, R. Tammivaara, P. Tukiainen, K. Venho, V. Vilkka.
RÉSUMÉ: Vingt six patients hypoxémiques atteints d'une bronchopneumopathie chronique obstructive (BPCO) sévère et stable ont été traités par oxygénothérapie continue au domicile pendant une période de 6 mois. Ils ont été évalués respectivement 1, 3 et 6 mois après le début de l'oxygénothérapie. Outre les analyses des gaz du sang, 15 critères de réaction ont été évalués par le patient et par l'infirmière, qui a apprécié également l'activité générale des patients. La dépression a été mesurée par le Beck Depression Inventory au début de l'essai et après six mois d'oxygénothérapie. La réponse psychosociale générale fut limitée. L'on n'a observé de modification significative d'aucun des critères psychosociaux. La réponse fut légèrement meilleure chez les patients plus jeunes et moins hypoxémiques. Nous concluons que la réponse psychosociale à l'oxygénothérapie est limitée dans les bronchopneumopathies chroniques obstructives sévèrement hypoxémiques.
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