Shimane J. Med. Sci., Vol.14 pp.19-21, 1995/96

EFFECT OF HOME OXYGEN THERAPY (HOT) ON THE PROGNOSIS IN CHRONIC HYPOXEMIC PULMONARY DISEASE

Yutaka ISHIBASHI, Isao IKUMA, Kazuya SANO, Jyun HATANO, Hironori TSUKIHASHI, Kazuaki TANABE, Tetsuhiro UMENO, Rinji MURAKAMI, You MURAKAMI, Toshio SHIMADA, Shigefumi MORIOKA* and Katsutoshi MORIYAMA**

Fourth Department of Internal Medicine, Shimane Medical University, Izumo 693,
**Cardiovascular Division, Kobe Municipal Hospital, Kobe,*
***Professor Emeritus, Shimane Medical University, Izumo 693, Japan*

Key Words : Chronic hypoxemic pulmonary disease / Home oxygen therapy / Prognosis

(Accepted December 15, 1995)

We examined the effect of a long-term home oxygen therapy on prognosis in patients with chronic hypoxemic pulmonary diseases. The oxygen therapy group (HOT group) consisting of 33 patients and the non-oxygen therapy group (CONTROL group) consisting of 32 patients were studied. The mean observation period were 53±22 months in HOT group and 47±19 months in CONTROL group. Cumulative surviving rate curve was not significant different between HOT group and CONTROL group. In contrast the surviving rate curve in patients with pulmonary emphysema significantly higher in HOT group than in CONTROL group after 40 months, while until 40 months the curve was higher in CONTROL group. In patients with the arterial partial oxygen pressure less than 60 Torr the difference was more distinct. Effect of home oxygen therapy on prognosis was demonstrated after long term followup in patients with severe hypoxemic emphysema.

Quality of life and prognosis in patients with chronic obstructive pulmonary diseases (COPD) has been markedly improved by home oxygen therapy (HOT). However, survival on HOT is related to the severity of COPD at the start of HOT. We studied the difference of survival rate between patient group with HOT and patient group without HOT.

SUBJECTS AND METHODS

Sixty-five patients, consisting 33 patients in HOT group and 32 patients in CONTROL group, who had various chronic pulmonary diseases with the arterial partial oxygen pressure below 60 Torr under air respiration at rest were studied. Table I shows distribution of basal diseases in both groups. Table II shows the age, sex, respiratory function and arterial blood gas analysis.

The observation period in HOT group was from April 1, 1986 to March 31, 1993 with the mean value of 53±22 months while that in CONTROL group was from April 1, 1980 to March 31, 1987 with the mean value of 47±19 months.

Correspondence to : Yutaka Ishibashi, The Fourth Department of Internal Medicine, 89-1 Enyacho, Izumo City, Shimane, 693 Japan Tel 0853-23-2111(ext 2548) Fax 0853-21-9221

Cumulative surviving rate curves were obtained by the Kaplan-Meier method and significant difference was assessed by the logrank test with $p<0.05$ as significant.

Various oxygen concentrators were used for oxygen inhalation in HOT group and the inhalation volume was decided so as to make the arterial partial oxygen pressure between 70 and 80 Torr. The hours of oxygen inhalation per day was 18 hours and more. In both groups, the observation was started when symptoms in patients had been stabilized. The patients who should be in hospital due to unstable clinical state and who were transferred to other hospitals were excluded from this study.

Table I. Basal pulmonary disease in HOT group and CONTROL group

	HOT	CONTROL
	33	32
COPD		
Emphysema	14	15
DPB	2	1
Others	3	7
Old Tuberculosis	2	2
Bronchial Ectasia	3	2
Pulmonary Fibrosis	4	3
PPH	3	1
Lung Cancer	2	1

COPD:chronic obstructive pulmonary disease, DPB:diffuse panbronchiolitis, PPH:primary pulmonary hypertension.

Table II. Clinical findings in HOT group and CONTROL group

	n	sex	age	follow-up (months)	PaO2 (Torr)	PaCO2 (Torr)	%VC (%)	FEV1% (%)
HOT	33	M27, F6	68±8	53±22	54.0±6.3	43.4±6.3	74.3±18.2	46.5±16.2
CONTROL	32	M23, F9	72±6	47±19	58.6±7.6	42.1±4.0	73.0±19.4	56.5±17.7
p value			NS	NS	NS	NS	NS	NS

PaCO2: arterial oxygen partial pressure, PaCO2: arterial carbon dioxide partial pressure, %VC: percentage of vital capacity, FEV 1%: percentage of forced expiratory volume in 1 second.

RESULTS

(1) Cumulative surviving rate curves for all the patients (Fig. 1)

Up to 30 months, the surviving rate in CONTROL group was significantly higher ($p<0.01$) than that in HOT group, and after 30 months a higher, but not significant, surviving rate was shown, too. The 5-year surviving rate was 45 % in CNTROL group and 40 % in HOT group with no significant difference.

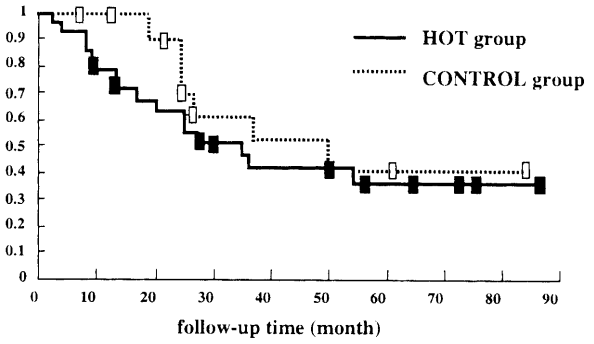

Fig. 1. Cumulative surviving rate curves in all patients with home oxygen therapy (HOT group) and patients without oxygen therapy (CONTROL group)

(2) Cumulative surviving rate curves in patients with pulmonary emphysema

Fig. 2 shows the surviving rate curves in 14 patients with pulmonary emphysema in HOT group and in 10 patients in CONTROL group. Up to 22 months, CONTROL group significantly showed a higher surviving rate ($p<0.05$), however after 40 months the surviving rate was significantly higher in HOT group than in CONTROL group ($p<0.05$).

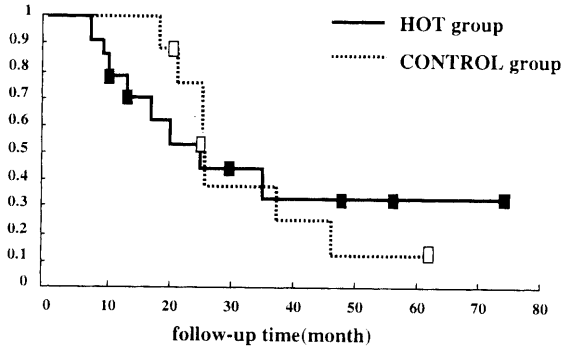

Fig. 2. Cumulative surviving rate curves in patients with pulmonary emphysema

(3) Surviving rate curves in patients with pulmonary emphysema and arterial partial oxygen pressure below 60 Torr at rest

The subjects were 10 patients in HOT group and 6 patients in CONTROLgroup. Although up to 30 months CONTROL group showed a highervalue compared to HOT group, after 40 months no survivor was found in CONTROL group (Fig. 3). In contrast, HOT group showed the surviving rate by 42 % after 40 months.

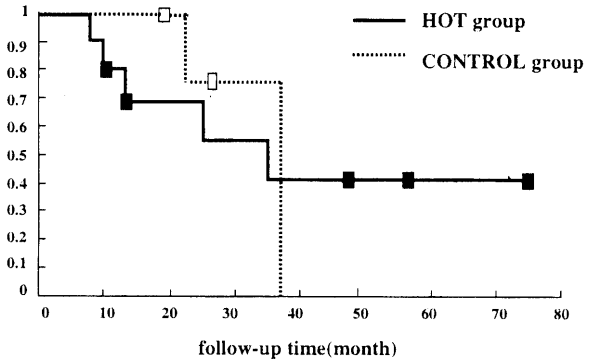

Fig. 3. Surviving rate curves in patients with pulmonary emphysema and PaO2<60 Torr at rest

DISCUSSION

NOTT (1) in U.S.A. and MRC (2) in U.K. reported that HOT improved prognosis of the patients with chronic pulmonary diseases. NOTT compared the surviving rates between 12- hour nocturnal oxygen inhalation group and 24-hour continuous inhalation group, consisting of a total of 203 cases of chronic pulmonary diseases, and showed that a significantly higher surviving rate in continuous inhalation group ($p<0.01$). MRC study reported the 5-year surviving rate under HOT in patients with chronic bronchitis and pulmonary emphysema was 30 %, other investigators reported similar data (4). In contrast Cooper *et al*. (3) reported the 5-year surviving rate in patients with 15-hour oxygen inhalations was 62 %. In this study, the 5-year surviving rate in HOT group was 42 %, consistent with previous studies.

However, the 5-year surviving rate in CONTROL group was higher than those in other reports. This difference might be derived from the fact that the degree of severity of the patients in our CONTROL group was relatively lighter clinical state compared to that in other reports. Because, the serious patients with distinct hypoxemia who needed oxygen inhalation were excluded from the subjects in CONTROL group in this study.

With respect to basal diseases, improvements of prognosis in patients with pulmonary fibrosis or bronchial ectasia have been reported to be difficult in spite of oxygen therapy, while in patients with pulmonary emphysema or old tuberculosis beneficial effect of oxygen therapy have been reported by many investigators (5,6). In our study, prognosis in patients with pulmonary fibrosis or bronchial ectasia were 1 year and 2 years (respectively) in HOT group and 0.9 years and 1.7 years (respectively) in CONTROL group. In patients with pulmonary emphysema, however, significant improvement was found in long-term prognosis in HOT group as shown in Figs. 2 and 3. The beneficial effect on prognosis in HOT was remarkable in patients with arterial partial oxygen pressure below 60 Torr. This result differs from other reports that the beneficial effect on prognosis in patients with pulmonary emphysema and arterial partial oxygen pressure below 60 Torr (7) was not be expected. However, the number of patients in our study was small to get a conclusion.

As the mechanisms by which HOT showed improvement in the surviving rates, Ikuma *et al.*(8) suggested that HOT improved the pulmonary hemodynamics as well as the right ventricular function in patients with COPD. They reported that the right ventricular ejection fraction which had been dropped by ergometer exercise before HOT increased by exercise after HOT, and concluded that the improvement of the right ventricular function could be produced by the improvement of right ventricular myocardial tissue properties during a long-term oxygen inhalation. This improved myocardial function might be considered to play role in the improvement of surviving rate in HOT group. As other mechanisms, we should consider facts that increases in appetite and improvements in mental state in patients with HOT increased resistance to lung infections. Because lung infections is the most frequent cause with which patients with COPD die.

It is necessary to carry out the follow-up study of the effects of HOT on prognosis in patients with COPD that modification of the present oxygen supply systems and development of new oxygen supply systems should be desired to enable a long-term oxygen supply.

ACKNOWLEDGMENT

The authors wish to thank all the members of the Fourth Department of Internal Medicine, Shimane Medical University and Professor Emeritus Moriyama for his guidance throughout the study.

REFERENCES

1) Nocturnal oxygen therapy trial group. (1980) Continuous or nocturnal oxygen therapy in hypoxemic chronic obstructive lung disease. Ann Intern Med, 93, 391-398

2) Medical research council working party. (1981) Long term domiciliary oxygen therapy in chronic hypoxic cor pulmonale complicating chronic bronchitis and emphysema. Lancet I, 681-686

3) Cooper, C.B., Waterhouse, J., Howard, P. (1987) Twelve year clinical study of patients with hypoxic cor pulmonale given long term domicialy oxygen therapy. Thorax 42,105-110

4) McSweeny, A.J. (1982) Life quality of patients with chronic obstructive pulmonary disease. Arch Intern Med 142, 473-478

5) Johnston, R.N., Mcneil, R.S., Smith, D.H., Legge, J.S., Fletcher, F. (1971)Chronic bronchitis: measurements and observations over 10 years. Thorax 31,25-31

6) Machida, K. (1988) Home management of chronic respiratory failure. Kekkaku 63, 84-90 (in Japanese)

7) Kawakami, Y., Kishi, F., Yamamoto, H., Miyamoto, K. (1983) Relation of oxygen deliverly, mixed venous oxygenation and pulmonary hemodynamics to prognosis in chronic obstructive pulmonary disease. N Engl J Med 308, 1045-1049

8) Ikuma, I., Ishibashi, Y., Murakami, Y., Nakazawa, Y., Murakami, R., Morioka, S., Moriyama, K. (1989) Improvement of right ventricular systolic performance by long-term domiciliary oxygen therapy in patients with chronic respiratory failure. Jpn Circ J 53, 756-762