MEDICAL PRACTICE

*General Practice Observed***How patients use domiciliary oxygen**

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British Medical Journal, 1978, 1, 1397-1400**Summary and conclusions**

Forty-five patients in Southampton who received domiciliary oxygen were visited at home to find out how they used and coped with their oxygen. Generally, the organisation and administration of supplies presented no problems, nearly all the apparatus complied with the drug tariff, and most patients coped well with the equipment. Only two patients were taking oxygen for prescribed periods; the others were taking it when necessary for symptomatic relief. No patient received oxygen for over five hours daily. Most patients thought that they were helped by oxygen, but only four said that it allowed them to increase their level of activity, and the overall benefit seemed slight. This was partly because oxygen was usually limited to one room, so patients used oxygen after rather than during exercise. The amount of oxygen consumed differed widely, ranging from three and a half cylinders a week in three patients to less than one cylinder in six months in 17 patients. The average yearly cost of oxygen per patient ranged from £500 in patients consuming one cylinder or more per week, to £15 in those consuming less than one cylinder in six months.

The main cost of domiciliary oxygen is determined by the number of cylinder refills, so patients who use it infrequently are a relatively small drain on resources.

Introduction

Domiciliary oxygen is prescribed to alleviate symptoms of severe respiratory disability or to reduce complications of chronic hypoxia such as polycythaemia and pulmonary hypertension. Oxygen may relieve both these complications,¹⁻³ though it must be given for 15 hours a day to maintain appreciable reductions in pulmonary artery pressure.⁴⁻⁶ A multicentre MRC trial is assessing the effect of long-term oxygen administration on morbidity and mortality in patients with chronic bronchitis.

In clinical practice, however, oxygen is more often given to relieve symptoms and reduce breathlessness associated with minor activities such as walking or dressing. Little is known about how patients use and cope with domiciliary oxygen in practice, so we decided to investigate this in Southampton, where no studies of prolonged oxygen treatment have taken place. The area is probably reasonably representative of other parts of Britain. A study in Dundee in 1966⁷ highlighted the risks of uncontrolled oxygen treatment in patients with respiratory failure, and led to changes in the oxygen mask supplied on the drug tariff. Our study was designed to find out how patients use oxygen; how much oxygen they consume; whether they think that oxygen is beneficial; and to estimate the cost of oxygen per patient year.

Patients and methods

Administration of oxygen for domiciliary practice—Twelve chemists in Southampton have contracted with the Family Practitioner Committee (FPC) to supply domiciliary oxygen sets (control heads, connecting tubing, and mask) and oxygen cylinders. They are responsible for stocking equipment and for delivering and collecting it from the patient's home. The initial capital outlay on each oxygen set is reclaimed as a monthly rental from the FPC by the chemist by means of a return form (FP66) which gives details of all sets on loan. The cylinders are obtained by the chemist from the British Oxygen Company (BOC) and are not paid for directly. The money is recouped

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by BOC on the charge for each cylinder refill, and this money is then reimbursed to the chemist through prescriptions returned each month with form FP66.

We tried to contact all patients in Southampton who were using domiciliary oxygen in September 1976. The information on form FP66 enabled the FPC to forward a letter to general practitioners asking permission for their patients to be contacted. Letters were then sent to patients asking permission for a medical student (MJ) to visit them at home. The purpose of the study was explained to the general practitioners, the patients, and, when relevant, to the patient's hospital consultant. The study was approved by the Southampton ethical committee and the FPC. The interviews, which took 20-30 minutes, were conducted informally, but were structured around a four-page questionnaire filled in by MJ. Oxygen sets and equipment were inspected, any potential fire hazard was assessed, and the reading on the cylinder content gauge noted so that oxygen consumption could be checked.

Results

The return forms showed that 56 patients in Southampton (population 213 000) had received oxygen at home in September 1976, and 45 of these (80%) were visited at home. Eleven patients were not seen because either the general practitioner could not be traced from the return form (two patients), consent from the general practitioner or consultant was not obtained (five patients), or the patient had deteriorated or died (four patients). Three patients were visited, though they had returned their equipment between September and the visit four months later.

Details of the 45 patients are shown in table I. Most were men. The mean age was 69 (range 48-85) years. The actual diagnosis was not sought from the general practitioner or hospital notes, but most patients described themselves as having chronic bronchitis with varying amounts of wheeze, and all but three had been cigarette smokers in the past. Two patients had been prescribed oxygen for long periods (five and 15 hours a day) in an attempt to reduce pulmonary hypertension. All the other patients received oxygen for symptomatic relief. Most patients were housebound, but two were still working at the time of study, both in non-manual jobs. One of these was the patient taking oxygen for five hours a day.

OXYGEN EQUIPMENT

All patients had 48 ft³ (1.4 m³) oxygen cylinders (table II), the only ones available on the drug tariff, and all but five patients used a 28% Ventimask. Only three patients had portable oxygen (Portogen, BOC). The oxygen sets have two settings, medium (2 l/min) and high (4 l/min). Twenty-six patients had been told which setting to use (medium for all but two). Patients who were not told or did not remember being told were more likely to use the high setting (13 out of 19). Most equipment was kept in the living room or the bedroom (table III). In two homes patients were taking oxygen only four feet away from an open or gas fire. All spare cylinders were stored well away from the fire, and all patients denied smoking while using oxygen.

HOW MUCH OXYGEN DO PATIENTS CONSUME?

Patients had received oxygen for between one month and 13 years (mean 3½ years). On the basis of their oxygen consumption they were divided into high (eight patients), moderate (17 patients), and low oxygen consumers (17 patients).

High oxygen consumers (one cylinder or more per week)—The three patients consuming most oxygen were using three and a half cylinders

TABLE II—Details of oxygen apparatus used by patients receiving domiciliary oxygen

Apparatus	No of patients
Oxygen cylinders (48 ft ³ ; 1.4 m ³)	42*
Oxygen sets:	
British Oxygen Company	37
W Kiddle; Air Apparatus and Valve	5
Masks:	
28% Ventimask	37
24% Ventimask	1
Nasal cannulae	2
Hudson mask	1
Polymask	1

*Three patients had returned their equipment.

TABLE III—Siting of oxygen apparatus in homes of 42 patients

	Living room	Bedroom	Toilet	Cupboard	Garage	Hall
Cylinders in use	22	20	1	3	1	
Stored cylinders (full)	4	9		2	8	1

a week (about five hours a day), and included the two patients prescribed oxygen for prolonged periods (15 and five hours a day). Patients' assessment of oxygen usage and that calculated from the cylinder turnover correlated well, except for one patient. This patient, who was prescribed oxygen for 15 hours a day, claimed to be taking it for 20 hours a day, but his turnover of oxygen cylinders showed him to be averaging only five hours a day. The third patient using three and a half cylinders a week was thought to be psychologically dependent on oxygen by her general practitioner.

Medium oxygen consumers (one cylinder lasting 1-26 weeks)—The correlation between the patients' estimate and our estimate of oxygen consumption from cylinder turnover was better in this group than the low oxygen group; overall, patients tended slightly to overestimate oxygen usage.

Low oxygen consumers (one cylinder lasting over six months)—Four of the 17 patients in this group had not used their oxygen in the past six months and one had never used his oxygen, which had been supplied "in case of need."

WHEN DO PATIENTS USE OXYGEN?

Patients used oxygen mainly first thing in the morning and last thing at night, when many found dressing and undressing difficult. The main requirement for oxygen was to cover activities such as dressing, but generally patients could not take it during exertion. Most took oxygen after exertion, though some used it beforehand. Oxygen was usually taken for about 10 minutes in all three consumption groups. The main difference between the groups was the frequency of oxygen usage.

BENEFITS OF OXYGEN

Although 37 of the patients (83%) claimed some benefit, usually relief of breathlessness, only four thought that oxygen enabled them to increase their level of activity—to climb stairs for two patients, and to walk around the room instead of being chairbound for two. Two of these patients took oxygen before and two after exertion. All patients with salbutamol inhalers were asked whether, given the choice, they would prefer to keep their salbutamol inhaler or their oxygen. Out of

TABLE I—Details of 45 patients receiving domiciliary oxygen

Sex		No living alone	Employment			Severity of dyspnoea (MRC grading)			Smoking habits		
M	F		Age ≥ 65	Age < 65		3	4	5	Previous smoker	Previous heavy smoker (>20 cigarettes/day)	Current smoker
				Working	Retired†						
38	7	8	31*	2	12	6	2	37	42	30	15

*Six patients had retired prematurely.

†These patients had retired prematurely.

28 patients with salbutamol inhalers, 14 chose salbutamol, 10 chose oxygen, and four were undecided. All patients in the high-oxygen consumption group preferred oxygen to salbutamol.

HOW EXPENSIVE IS DOMICILIARY OXYGEN?

During this study 517 patients in Hampshire were receiving domiciliary oxygen with an average consumption of 22 cylinders per patient year compared with 24 cylinders per patient year for the 45 patients in Southampton. One cylinder lasted for 16 days on average for patients in Hampshire and 15 days in Southampton. Since oxygen usage in Southampton was similar to Hampshire, we used the yearly oxygen expenditure for Hampshire (£62 000 during the previous financial year) to estimate the cost of oxygen per patient year, assuming the September figures to be representative of the whole year. The average cost per patient in Hampshire was £119 a year, of which roughly £60 was spent on oxygen refills, £17 on rentals for oxygen sets, and £42 on professional fees. Since the major cost is related to cylinder refills, the bulk of the expense lay in the high-consumption group (see table IV).

TABLE IV—Average yearly cost per patient and total yearly cost of domiciliary oxygen in Southampton, according to oxygen consumption

Consumption group:	High	Medium	Low
No of patients	8	17	17
Time taken to use one cylinder (weeks)	0-1	1-26	>26
Average cost per patient year (£)	500	110	15
Total yearly cost (£)	4000	1390	255

Discussion

We aimed at finding out how patients in Southampton were using domiciliary oxygen in practice; we did not try to assess the need for oxygen objectively. All the cylinders and control heads complied with the drug tariff, and patients were usually satisfied with the service provided. Generally the apparatus was not difficult to use, and when the chemist was not present either the patient or a relative would change the cylinder head. When patients did not know which flow setting to use they tended to use the high setting of 4 l/min instead of the recommended 2 l/min, so better communication on this point would save oxygen. The organisation and costing system for domiciliary oxygen is complicated but generally seemed to work well, though in some instances oxygen equipment was redundant and occasionally out of date. All patients were aware of the fire hazard associated with oxygen, though in two homes the oxygen cylinder was rather close to an open fire. The risk of fire seems to be slight.⁸

The 28" Ventimask (the standard drug tariff issue) was the most commonly used mask, and patients usually found it acceptable to wear. This mask is generally thought to be safe, though it may produce CO₂ narcosis in some patients with respiratory failure.⁹ Many patients receiving oxygen will have chronic respiratory failure and may use more oxygen during an acute exacerbation of bronchitis, when CO₂ narcosis might occur. It is difficult to find out whether this is a major practical problem with the 28" Ventimask. The Polymask found in one home gives much higher concentrations of oxygen¹⁰ and may produce considerable CO₂ narcosis, drowsiness, and confusion when used in domiciliary practice.⁷ The Hudson mask and nasal cannulae¹¹ were each used at the lower flow rate (2 l/min), which is probably acceptable for controlled oxygen treatment.

All our patients received supplies from chemists in Southampton, who had a strong financial incentive for ensuring that their returns of form FP66 were complete. A separate check confirmed that chemists not returning form FP66 supplied no patients with oxygen. Our study did not include patients supplied by chemists outside the city boundary, but such patients are probably few. Most patients (80%) were seen at home, and were probably representative of the whole group, since the exclusions were for

various reasons unlikely to introduce bias. The pattern of use was not unduly influenced by any particular doctor, since no general practitioner had more than four patients and no consultant more than two patients receiving oxygen.

As expected our results show that patients receiving domiciliary oxygen are a heterogeneous group with large differences in oxygen consumption. This must be taken into account when considering other methods of oxygen delivery, such as oxygen concentrators, for which the large capital outlay¹² would not be justified in patients using little oxygen. The single patient in Southampton prescribed oxygen for 15 hours a day was taking oxygen for only about five hours. Patient compliance may be a problem if long-term continuous oxygen treatment is widely advocated as a result of the current MRC trial. Apart from two patients advised to take oxygen for prescribed periods every day, the rest were receiving it for symptomatic relief. This is usually done without an objective assessment of improvement in exercise tolerance, so it is difficult to know how much benefit is physiological and how much psychological. We did not set out to answer this question, but gained some idea of subjective benefit from the patients. Most thought that oxygen gave some symptomatic relief, though only four thought that it enabled them to achieve an increased level of activity. In a group of patients in whom bronchodilators are usually thought to have little effect more patients would have preferred to keep salbutamol rather than oxygen if given the choice.

Generally the symptomatic benefit of domiciliary oxygen to patients in the community seems slight. This contrasts with laboratory studies of selected patients, which showed that exercise tolerance was substantially increased by oxygen treatment.^{13,14} One of the main reasons for this difference is that unlike studies in the laboratory domiciliary oxygen cannot easily be taken *during* exertion. Most of our patients were restricted by the length of connecting tubing, and used oxygen only *after* exertion. This should be considered when trying to assess the likely benefit of domiciliary oxygen from objective tests of exercise tolerance in the laboratory. Several patients thought that they could do more if they had either portable oxygen or two oxygen sets strategically placed at home, though only two of the four patients with two sets actually used the second set. Neither alternative would necessarily fulfil their expectations, however, since the three patients with portable oxygen used it infrequently, usually for car journeys or visiting friends. This was partly because the supply lasts for less than half an hour with the lightweight portable compressed oxygen cylinders, which weigh 1.5 kg (Portogen; BOC). Portable liquid oxygen lasts much longer, but the work required to carry the additional weight (4.5 kg) offsets the increased exercise tolerance due to oxygen.¹¹ Improving the present system by simply increasing the length of the connecting tubing is unlikely to be helpful, since the oxygen would still be essentially confined to one room, while "exercise" usually consists of walking from one room to another. The long length of tubing would itself be an obstacle to walking, while the increased weight of tubing would tend to pull the mask from the face. For patients with objective improvement from oxygen two sets should be considered and would cost little more than one set, unless oxygen consumption was greatly increased.

Oxygen consumption per patient year in Southampton is similar to the rest of Hampshire, ranging from £500 per patient in the high-consumption group to £15 in the low-consumption group. With the present costing system the cost per patient depends on the amount of oxygen used; hence the bulk of the expense lies in the high-consumption group. The cost for the three patients using three and a half cylinders a week was £1000 per patient year, and would be trebled if patients were taking oxygen for 15 hours a day. Patients who take over six months to use one cylinder are a relatively small drain on the resources. The benefit in this group is probably largely psychological, but the cost compares favourably with other placebo treatments.

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If I Had . . .

A melaena

A PATON

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Introduction

The scene is a hospital ward. I am conducting a ward round and suddenly feel faint and queasy. I sit down beside the bed; it must be the overheated ward or the tedium of the round. But as I get up, the world starts swimming and I have an overwhelming desire to defaecate, so that I have to rush to the ward lavatory. I pass a large melaena stool, and almost faint when I try to stand up, but, after sitting for a few minutes, feel better and walk feebly back to the ward. The shocked faces that greet me mirror my own concern, and I am led meekly by sister to her office.

Decisions

The first decision is whether to go home. I have a strong antipathy towards hospitals and firmly believe that for many serious conditions home is the best place to be, provided it is properly equipped, not only in the utilitarian sense but also with ever-loving family and a caring general practitioner. But gastrointestinal bleeding? A true haematemesis—and I don't mean the vomit that contains streaks of blood—or a true melaena probably means the loss of at least 500 ml blood and therefore requires admission to hospital. (I must confess that if it had happened at home I might have stayed put.) So where and by whom? Naturally, I believe that gastrointestinal bleeding is a medical problem best dealt with in a general ward. I have no sympathy for takeover bids from surgeons or intensive care units. So I elect for a general physician used to emergencies, with the knowledge that he would co-operate with a general surgeon of similar experience if the need arose.

I have always thought, and it's not very original, that the

clue to proper treatment of emergencies is to get your priorities right. If you have a serious haemorrhage I imagine the first thing you want is reassurance and peace and quiet; in a word, sedation. Nowadays this seems to be a wicked thought, for mainly irrational reasons engendered by populist ideas and the obsession with technology. In spite of possible disadvantages, there is still much to be said for an injection of morphine, or perhaps omnopon, to minimise the risk of vomiting, and my favourite alternative remains intramuscular sodium phenobarbitone. But I am prepared to settle for diazepam if my physician insists.

Resuscitation

A specimen of blood is then taken, not only for grouping and cross-matching, but also for estimating liver function tests, urea and electrolyte concentrations, a full blood count (including platelets), and prothrombin time. An intravenous drip is set up and saline infused *slowly* while waiting for blood, which is what I need. Plasma or dextran might be given if I am shocked, but I would strongly resist the current enthusiasm for central venous pressure lines. Most bleeding can be managed by conventional means.

Once the blood is running I feel safe, provided my attendants resist another prevalent tendency to give large quantities. Meanwhile the nurses are doing their bit with hourly pulse and blood pressure measurements, and keeping a measured record of any further blood loss. If the ward sister is one of those who can "smell" bleeding that is an added bonus. Fluids and light food are allowed in most circumstances; it is extraordinary how persistent is the obsolete practice of "nil by mouth," so many years after Avery Jones showed that feeding actually improved the outlook. Likewise a Ryle's tube is unnecessary and may be positively harmful.

Investigation

For the patient the precise cause of the bleeding has a fairly low initial priority, and it is really only at this stage that the

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