CASE REPORT

HOME OXYGEN THERAPY AND CIGARETTE SMOKING: A DANGEROUS PRACTICE

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SUMMARY. Oxygen as a therapeutic agent is an important form of home therapy for hypoxic chronic obstructive pulmonary disease (COPD) and improved survival has been demonstrated in hypoxic COPD patients receiving continuous oxygen. However, some patients, despite dissuasion, continue to smoke and we describe the case of a patient on home oxygen who sustained a partial-thickness facial flash burn whilst engaged in this habit. A review is made of the literature, as also a comparison of all discovered cases of burns in home oxygen users, followed by a discussion of the implications of this potentially hazardous form of therapy.

Introduction

Oxygen as a therapeutic agent was first introduced by Alvin Barach[1] in 1922 and since then it has become an important form of home therapy for hypoxic chronic obstructive pulmonary disease (COPD). Its use has increased dramatically over the last 20 years since two pivotal studies demonstrated improved survival in hypoxic COPD patients receiving continuous oxygen.[2,3] The single most important cause of COPD is cigarette smoking, and a significant number of patients continue to smoke despite being on home oxygen therapy.

We describe the case of a patient on home oxygen who sustained a partial-thickness facial flash burn whilst smoking.

Following a review of the literature we compare all discovered cases of burns in home oxygen users and discuss the implications of this potentially hazardous form of therapy.

Case report

A 58-yr-old man presented to hospital with a facial flash burn resulting from lighting a cigarette whilst on home oxygen. He described how "the cigarette just exploded" on lighting. He had sustained a 3% superficial facial burn, with singed eyebrows and nasal hairs and soot in the nostrils (*Fig. 1*).

Fig. 1 - Facial flash burn.

The patient had a past medical history of asthma, smoking-induced COPD, a recent diagnosis of bronchial carcinoma, and chronic schizophrenia. He was receiving 2 litres per min of home oxygen via nasal cannulae and a concentrator.

On examination his airway was clear with bilateral wheeze. He had reasonable air entry on auscultation and an oxygen saturation of 94% on 2 litres of oxygen. He was haemodynamically stable with a normal cardiovascular examination. A review by an anaesthetist revealed a normal oropharnyx. He was admitted to the high dependency unit for observation and kept on humidified oxygen and nebulized salbutamol. The burn was left exposed, being managed conservatively with the application of paraffin oil. Two days later his chest had improved sufficiently to allow transfer to the ward. After careful education on the safe use of his oxygen he was allowed home.

Discussion

There are three types of home oxygen supply available: oxygen concentrators, which supply long-term continuous oxygen, cylinders, which supply intermittent oxygen, and liquid oxygen systems. Delivery occurs via nasal cannulae (most commonly), face-masks (often described as uncomfortable), or transtracheally (rarely used).

The oxygen is used according to one of three patterns: continuous for more than 15 h a day (as in COPD patients), intermittent, and nocturnal oxygen therapy.

Unfortunately, compliance with prescribed oxygen has been reported to be as low as 22%.[4-6] Smoking is considered a contraindication to the provision of home oxygen. Patients are told not to smoke, but recent surveys show the percentage of home oxygen users still smoking to be between 14 and 51%.[7]

The fire and burn injury risk of home oxygen use is increasingly being recognized but the actual incidence of burns in home oxygen users is unknown as many cases are likely to be unreported.

We conducted a literature review in order to identify and compare all reported cases of burns in home oxygen users. Patient demographics, oxygen delivery system, burn severity, associated cigarette smoking, and patient outcome were recorded.

We found four major series; Robb et al. (2003),[8] Chang et al. (2001),[9] Barillo et al. (2000),[10] and Muehlberger et al. (1998).[11]

Out of these, a total of 86 cases of home oxygen burns were thus identified, the patients having a mean age of 65 yr; the most common diagnosis was COPD. Fifty-four patients were smokers, 11 were non-smokers, and 21 were unspecified. The average burn size was 8.1% of total body surface area, with seven patients sustaining full-thickness burns and two requiring skin grafting. Twenty-one patients suffered an inhalational injury. The length of hospital stay averaged 4.6 days and nine patients died. Several authors also noted an apparent increase in the incidence of oxygen-related burns.

The combustion of most materials requires a fuel, a heat source, and an oxidizing agent.[11-15]

Most patients on home oxygen use nasal cannulae. Nasal cannula tubing is a polyvinyl chloride product which, when ignited, emits an intense flame, possibly owing to the release of highly flammable vinyl chloride gas.

The prongs of a cannula are intended to direct oxygen into the nose. Greco et al.[15] showed, however, that a significant amount of oxygen exits the nose and constantly leaks out and bathes the lower face. An oxygen-enriched environment facilitates ignition and combustion of any material.

Flash fires ignited by electrocautery and oxygen flow from nasal cannulae during facial surgery under local anaesthesia have been described,[13] and Reyes et al.[14] used a facial flash fire model to show how nasal cannula tubing can be ignited by an electrocautery spark at an oxygen flow rate of 2 litres per min and at a linear distance of 5 cm from the oxygen source.

The cause of the flash burn in the patient we described was probably related to the inherent flammability of human tissue with the cannula tubing as the fuel, the flame of the cigarette lighter as the heat source, and oxygen flowing through the cannula and saturating the perioral region as the oxidizer.

Patients who smoke whilst on home oxygen expose themselves to a significant and avoidable burn injury risk.

Conclusion

An increasing number of home oxygen burns have been reported in the literature over the past decade, most likely related to the more prevalent use of home oxygen and an ageing population.

The use of a less combustible material for cannula tubing and a more efficient oxygen delivery system may reduce the incidence of such burns. Another suggestion would be labelling the oxygen cylinders with large stickers emphasizing the danger of smoking in the presence of oxygen. But most important is the need for more aggressive warning and education of the patients and their families by GPs and physicians to raise awareness of this potentially explosive practice.

RÉSUMÉ. L'oxygène comme agent thérapeutique constitue une forme importante des soins domestiques pour la maladie pulmonaire obstructive chronique hypoxique et une amélioration a été démontrée dans la survie des patients atteints de cette maladie qui reçoivent l'oxygène en manière continuelle. Cependant, certains patients, malgré la dissuasion, continuent à fumer et les Auteurs décrivent le cas d'un patient traité à la maison avec l'oxygène qui a été atteint de brûlures du visage à épaisseur partielle causée par un flux thermique tandis qu'il était en train de fumer. Les Auteurs considèrent la littérature relative, présentent une comparaison de tous les cas qu'ils ont découverts de brûlures subies par des patients qui utilisaient l'oxygénothérapie domestique, et concluent en discutant les implications de ce type de thérapie potentiellement risqué.

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This paper was received on 7 December 2005.

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