

Original Article

Burning HOT: revisiting guidelines associated with home oxygen therapy

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Abstract: Burn injuries secondary to home oxygen therapy (HOT) have become increasingly common in recent years, yet several guidelines for HOT and chronic obstructive pulmonary disease (COPD) neglect to stress the dangers of open flames. This retrospective review of burn injury admissions secondary to HOT to our burn centre from 2007 to 2012 aimed to establish the extent of this problem and to discuss the current literature and a selection of national guidelines. Out of six patients (five female, one male) with a median age of 72 (range 58-79), four were related to smoking, and two due to lighting candles. The mean total body surface area (TBSA) affected was 17% (range 2-60%). Five patients sustained facial burns, two suffered from inhalation injury (33.3%), and five required surgery (83.3%). Mean total length of stay was 20 days (range 8 to 33), and one patient died. Although mentioned in the majority, some guidelines fail to address the issue of smoking in light of the associated risk for injury, which in turn might have future implications in litigation related to iatrogenic injuries. Improved HOT guidelines will empower physicians to discourage smoking, and fully consider the risks versus benefits of home oxygen before prescription. With a view on impeding a rising trend of burns secondary to HOT, we suggest revision to national guidelines, where appropriate.

Keywords: Oxygen inhalation therapy, burns, smoking, pulmonary disease, chronic obstructive, guidelines, practice

Introduction

The last few decades show an increase in the prescription of Home Oxygen Therapy (HOT) for hypoxic patients with chronic obstructive pulmonary disease (COPD); synonymously, evidence of fires and burns owing to patients smoking whilst on HOT has also amounted [1-9]. The number of individuals receiving HOT is increasing with world prevalence's reaching about 280 per 100,000 people [10]. HOT is generally considered beneficial; it reduces hypoxemia and alleviates hypercapnia to increase survival and reduce hospitalization. However, between 5 and 51% of patients admit to continue smoking on HOT, and as smoking status is not routinely checked, these figures may be underestimated [11, 12]. As well as threatening their own lives, and the lives of those around them, these patients necessitate

longer hospitalization and use significant resources compared to the general adult burns population [3, 4]. A recent admission to our burn center of a patient with injury secondary to smoking on HOT prompted this investigation of related presentations. This sparks several issues regarding the risks versus benefits of oxygen prescription to current smokers, and the mention of associated hazards of open flames with oxygen in current HOT and COPD guidelines.

Patients and methods

This study is a retrospective data review of burn patients that were admitted and treated in our burn center, and entered into our database, between 2007 and 2012 (Ethics Committee Approval ECS 1111/2012, Medical University of Vienna). Patients who sustained burns whilst

Burning HOT

Table 1. Literature review of burns secondary to home oxygen therapy (HOT)

Authors	Litt	Amani [9]	Murabit [3]	Edelman [4]	Muehlberger [7]	Robb [5]	Chang [6]	Barillo [8]	Overall
Type of Study	Retrospective	Retrospective	Retrospective	Prospective	Retrospective	Retrospective	Retrospective	Retrospective	1978-2012
Study Years	2007-12	2000-10	1999-2008	2004-05	1990-97	1992-2001	1986-98	1978-97	
PATIENT DETAILS									
Patient Number	6	86	17	14	21	27	23	8	202
Mean Age	72.0	64.1	69.1	66.0	60.4	68.1	70.0	62.6	66.5
Male (%)	16.7	65.0	52.9	71.4	76.2	51.9	30.4	N/A	52.1
COPD (%)	100.0	91.0	100.0	100.0	90.5	93.0	87.0	N/A	94.5
ADMISSION DETAILS									
Mean Length Of Stay (d)	22.5	6.8	42.8	22.0	3.6	4.4	N/A	2.6	15.0
Mean TBSA (%)	17.0	2.5	2.8	3.9	2.0	8.4	3.9	10.7	6.4
Inhalation Trauma (%)	33.3	37.5	11.8	N/A	0.0	11.0	57.0	50.0	28.7
3 ⁺ Burns (%)	50.0	N/A	7.1	N/A	19.0	7.4	0.0	N/A	16.7
THERAPY									
Intubation (%)	50.0	36.0	11.8	N/A	0.0	11.0	18.5	N/A	21.2
Skin Grafting	83.3	N/A	23.5	N/A	9.5	N/A	N/A	N/A	38.8
OUTCOME									
Mortality (%)	16.7	3.0	11.8	50.0	0.0	15.0	8.7	25.0	16.3

Table 2. Smoking Considerations of Chronic Obstructive Pulmonary Disorder and Home Oxygen Therapy Guidelines

Society	Guideline	Year of Publication	Extracts and Comments
Guidelines Warning about the risks of Smoking on Oxygen			
National Institute for Health and Clinical Excellence [13]	Management of chronic obstructive pulmonary disease in adults in primary and secondary care. Clinical Guideline 12	2010	'Patients should be warned about the risks of fire and explosion if they continue to smoke when prescribed oxygen.'
British Thoracic Society [19]	Clinical Component for the Home Oxygen Service in England and Wales.	2006	'Smoking cessation techniques should be continued prior to any home oxygen assessment and prescription. Patients should be made aware of the dangers of continuing to smoke in the presence of home oxygen therapy.'
Australian Lung Foundation Thoracic Society of Australia and New Zealand [14]	The COPD-X Plan: Australian and New Zealand Guidelines for the management of Chronic Obstructive Pulmonary Disease.	2003	'The dangers of open flames (especially cigarettes, gas heaters and cookers) need to be emphasised.'
American Thoracic Society [20]	Standards for the diagnosis and treatment of patients with COPD.	2004	'The major physical hazards of oxygen therapy are fires or explosions. Most fires are caused by patients lighting cigarettes ... Patients, family and other care-givers must be warned not to smoke near oxygen.'
Guidelines NOT Warning about the risks of Smoking on Oxygen			
Austrian Society for Lung Diseases and Tuberculosis [21]	Regulation of Long-term oxygen therapy and Mechanical Breathing Aids.	2001	No reference to smoking
German Society for Pneumology and Respiratory Medicine [15]	Guidelines for Long-Term Oxygen Therapy: German Society for Pneumology and Respiratory Medicine	2008 2009	'...At each follow-up... Correct possible misconduct (e.g., smoking inhalation)' 'Every effort must be made to achieve complete cessation of smoking...'
Swiss Respiratory Society [16]	Management of the chronic obstructive pulmonary disease: the Swiss guidelines. Official Guidelines of the Swiss Respiratory Society.	2002	Only refers to smoking cessation for primary and secondary prevention of COPD.
The Canadian Thoracic Society [17]	Managing dyspnea in patients with advanced chronic obstructive pulmonary disease: A Canadian Thoracic Society clinical practice guideline.	2008	Only refers to smoking cessation for primary and secondary prevention of COPD.
NHLBI/WHO Workshop [18]	Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. NHLBI/WHO Global Initiative for Chronic Obstructive Lung Disease (GOLD) Workshop Summary.	2011	Only refers to smoking cessation for primary and secondary prevention of COPD

Abbreviations: COPD: chronic obstructive pulmonary disease; NHLBI: National Heart, Lung, and Blood Institute; WHO: World Health Organisation.

on HOT were identified and their demographic details, length of hospital stay, severity of burns, management, and outcome were collected for analysis.

Results

We identified six patients (five female, one male) sustaining burns on HOT. The median age was 72 (range 58-79) years; four patients sustained burns secondary to smoking (4/6=66.7%) whilst two lighting a candle (2/6=33.3%). The median total burn surface area (TBSA) was 17 (2-60)%. All but one patient sustained facial burns (5/6=83.3%) and two suffered from inhalation trauma (2/5=33.3%). One patient was managed conservatively, and the remaining five required operative intervention with wound debridement and skin grafting. Patients median length of stay was 25 (8-36) days; and one patient died due to multi organ failure on day 18 post injury (**Table 1**).

Discussion

This cohort's characteristics share similarities with previous reports corresponding to age and length of hospital stay. Unlike most previous series, this sample was predominantly female, and the severity of burns and TBSA were more substantial. The latter may be due to the majority of HOT burns in previous studies being commonly managed as outpatients [5]. Outpatient data was not obtained in this series. Recent reviews identified 14 patients every year for the last 3 consecutive study years [4, 9], reflecting a trend also witnessed by other studies, and possibly explained by the increasing proportion of patients on HOT [3, 6, 9].

Despite the amounting issue of burns secondary to HOT, an exploration of nine selected HOT and COPD guidelines revealed a neglect to stress the dangers of open flames with oxygen [13-21]. Only four guidelines state the risks of fires associated with smoking. Five guidelines do not warn about such risks, four of which refer to smoking cessation, but only with regards to the primary and secondary prevention of COPD. The Austrian guideline has no reference to smoking at all.

Incidentally, two of our patient's sustained burns lighting candles; other causes of HOT burns include lighting furnaces; lighting another

person's cigarette; lighting a stove; an electrical spark; and walking past an open flame [5, 9]. Of all the relevant guidelines, only the Thoracic Society of Australia, New Zealand and America specifically stressed the risks of open flames in general near oxygen, and not solely risks from smoking (**Table 2**).

There is a general consensus that more regular and assertive warnings about the dangers of smoking are needed to prevent the incidence of burns related to HOT [1-9]. However, as patients continue to smoke despite being counselled regarding the risks, methods to encourage abstinence also warrant researching [9]. In light of the rising trend in burns secondary to HOT, clear guidance needs to be established to ensure that physicians whom initially prescribe oxygen warn against fire risks, and evaluate the need for oxygen against the risk of injury. Present guidelines concerning the initial prescription of oxygen, particularly for active smokers are thought to be imprecise [2, 11]. In addition, over-prescription of oxygen to patients not meeting hypoxic guideline criteria is common, and when followed-up appropriately a majority of patients no longer need continuing with it [11]. There may be a large proportion of patients inappropriately on HOT and at unnecessary risk of injury, therefore systematic follow-up and re-evaluation of patients is well warranted, and can reduce the risk of burns secondary to HOT.

Conclusion

It is essential to stress the hazards related to HOT within national guidelines. Such directives will empower healthcare professionals to discourage smoking, and fully consider the risks versus benefits before prescribing oxygen. With a view on impeding a rising trend of burns secondary to HOT, we suggest revision to national guidelines, where appropriate.

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