Available online at www.sciencedirect.com
ScienceDirect
journal homepage: www.elsevier.com/locate/burns

Case report

The Southwest UK Burns Network (SWUK) experience of electronic cigarette explosions and review of literature

A. Arnaout [a,*], H. Khashaba [b], T. Dobbs [a], F. Dewi [b], S. Pope-Jones [a], A. Sack [b], C. Estela [b], D. Nguyen [a]

[a] Plastic and Reconstructive Surgery, Welsh Centre for Burns and Plastic Surgery (WCBP), Morriston Hospital, Swansea, SA6 6NL, UK
[b] Department of Burns and Plastics, North Bristol NHS Trust, Southmead Hospital, Bristol, UK

ARTICLE INFO

Article history:
Accepted 5 January 2017
Available online xxx

Keywords:
Electronic cigarettes
E-cigarette
Explosion
Burn
Lithium-ion
Lithium battery

ABSTRACT

Introduction: Since the introduction of e-cigarettes to the UK market in 2007 their popularity amongst young adults has significantly increased. These lithium-ion powered devices remain unregulated by the Standards Agency and as a result burns centres across the world have seen an increasing number of patients presenting with significant burns, resulting from poor quality batteries that appear to be liable to explode when over-heated, over-charged or incorrectly stored.

Methods: Retrospective and perspective review of all e-cigarette related burns presenting to the Southwest Burns Network; South Wales Burns Centre (Morriston Hospital) or to Bristol burns centre (Southmead Hospital) between Oct 15-July 16, followed by a review of available literature performed and eligible papers identified using PRISMA 2009 Checklist.

Results: South Wales Burns Centre (Morriston Hospital) (N=5), Bristol burns centre (Southmead Hospital) (N=7). 92% of injuries were seen in male patients with a mean age of 34.58 (±12.7). The mean TSBA sustained 2.54% of mixed depth, most common anatomical area is the thigh 83% (n=10) with a mean 23.1(±5) days to heal with conservative management.

The literature search yielded 3 case series (Colaianni et al., 2016; Kumetz et al., 2016; Nicoll et al., 2016) [8,9,12] and 4 case reports (Jablow and Sexton, 2015; Harrison and Hicklin, 2016; Walsh et al., 2016; Shastry and Langdorf, 2016) [6,7,10,11]. We compare our findings with the published studies.

Conclusion: The import and sale of e-cigarettes remains unrestricted. This increases the risk of devices being available in the UK market that do not meet the British Standard Specification, potentially increasing their risk of causing fire and exploding. Consumers should be made aware of this risk, and advised of adequate charging and storage procedures.

* *Corresponding author.*
E-mail addresses: Ali.Arnaout@wales.nhs.uk, aarnaout@gmail.com (A. Arnaout), Oak_80@hotmail.com (H. Khashaba), Tom.Dobbs@wales.nhs.uk (T. Dobbs), Ffion_d83@hotmail.com (F. Dewi), Sophie.pope-jones@wales.nhs.uk (S. Pope-Jones), Anthony.sack@nbt.nhs.uk (A. Sack), Catalina.estela@nbt.nhs.uk (C. Estela), Dai.Nguyen@wales.nhs.uk (D. Nguyen).
http://dx.doi.org/10.1016/j.burns.2017.01.008

In case lithium ion compounds leak following a breach in the battery, first aid with mineral oil use is advocated to avoid a further chemical reaction.

1. Introduction

Electronic cigarettes remain fairly new, they were invented in 2003 in China, and introduced into the UK market in 2007 [1]. Most consist of three different components; a cartridge containing a liquid solution with varying amounts of nicotine, flavouring and other chemicals, a heating device (vaporizer) and a power source (usually a battery). E-cigarettes are designed to simulate the act of smoking but with less of the toxic chemicals produced by burning tobacco [2]. As they deliver nicotine without burning tobacco e-cigarettes appear as if they may be a safer, less toxic alternative to conventional cigarettes.

However the health consequences of how the absorption of nicotine and other compounds found in the e-cigarette vapour such as formaldehyde and acetaldehyde may be potentially toxic or carcinogenic is unclear. In the battle to lower smoking rates the e-cigarette has been promoted as a 'healthier way to smoke' and a method to help people to stop smoking. However evidence thus far to show a link with smoking cessation is lacking [3,4].

There were an estimated 1.3 million e-cigarette users in 2014 and this is likely to continue to increase [5].

We have witnessed an increasing number of burns as a result of spontaneous explosions of the e-cigarettes battery across South Wales and South West of England.

We present one of the largest published case series of burns from e-cigarette batteries, reviewing those already published and discussing the potential worldwide public health impact this has.

2. Methods

A retrospective and perspective review of all e-cigarette related burns that presented to either the South Wales Burns Centre (Morriston Hospital) or to Bristol burns centre (Southmead Hospital) between October 2015 and July 2016.

Retrospective patients were identified using the local the international Burn Injury Database (iBID) using terms "electronic cigarette" and "e-cigarette."

A review of literature was performed using OvidSp Medline®, the US National library of Medicine resources, and Google Scholar using keywords; "electronic cigarettes or e-cigarettes and burns"; "electronic cigarettes or e-cigarettes and explosions"

Eligible papers were identified using PRISMA 2009 Checklist.

The search yielded has two case series [8,9] and three case reports [6,7,11] published in the United States of America and a recent case series [12] and case report [10] published in the United Kingdom (UK) in 2016 (Table 1).

3. Case reports

3.1. *Case 1*

A 22-year-old man placed his e-cigarette on its charger where it then shot across the room and exploded, igniting the carpet. In attempting to extinguish the fire he sustained TSBA 1% superficial partial thickness burns to both hand and the sole of right foot (Figs. 1 & 2).

Treatment was conservative with Jelonet® based dressings, and a course of antibiotics to cover the foot burns; total time to complete healing 36 days.

3.2. *Case 2*

A 22-year-old man was carrying his e-cigarette in his right trouser pocket whilst at work in a factory. It suddenly exploded and he sustained a TSBA 1% mixed depth burn to his right medial thigh and scrotum (Figs. 5 & 6), and superficial partial thickness burns to his left hand whilst trying to extinguish the flames (Fig. 3).

Treated conservatively initially with Jelonet® based dressings, followed by Simple Mepilex® dressings; total time to complete healing 25 days.

3.3. *Case 3*

49 year-old sales manager, had put a lithium-ion battery of his e-cigarette in his right-side pocket along with some coins. He felt the battery is heating up and suddenly burst into flames and his jeans caught fire. Sustaining a 7% TBSA superficial partial thickness (SPT) burns flame burns with a central deep dermal area (Figs. 4 & 5).

Treated conservatively with Mepilex® Ag; total time to complete healing 20 days.

4. Results

From our findings; 92% of injures seen were in male patients (n=11), 8% in female patients (n=1) with a mean age of 34.58 Population SD (±12.7).

The most common anatomical area to sustain a burn from our findings is thigh 83% (N=10) compared to the overall 74% (N=17), followed by hand 16% (N=2) overall 13% (N=3).

The mean total surface body area sustained from our findings was 2.54% SD (±2) of mixed depth, with a mean of 23.1 SD (±5) days from presentation to complete healing with conservative management (Table 2).

Please cite this article in press as: A. Arnaout, et al., The Southwest UK Burns Network (SWUK) experience of electronic cigarette explosions and review of literature, Burns (2017), http://dx.doi.org/10.1016/j.burns.2017.01.008