

An Unusual Burn Injury Caused by an E-Cigarette

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Abstract

Presentation

We present the case of a burn wound of the left chest induced by the leaking hot liquid contents of an e-cigarette.

Diagnosis

A full thickness burn of 0.3% total body surface area (TBSA).

Treatment

A wound requiring formal surgical excision and reconstruction in the form of an autologous split skin graft.

Discussion/Conclusion

This case demonstrates a previously undescribed risk of e-cigarette use, resulting in an injury that required inpatient admission and treatment in a tertiary plastic surgery unit.

Introduction

E-cigarettes first became available in Europe in 2006; their use in Ireland has been popularised as an alternative to conventional cigarettes and an aid to smoking cessation. Powered by a lithium battery, the e-cigarette heats an “e-liquid” (containing a variable mixture of nicotine, water, a chemical solvent and flavourings) and converts it to a vapour. This, in turn, is inhaled by the user via a mouthpiece. However malfunctions in the e-cigarette mechanism have resulted in several injuries, some severe ¹, and even death ². While thermal and chemical burns associated with spontaneous battery explosion are the most common accidents ³, intra-oral trauma ⁴ and cervical spine fractures ⁵ have also occurred. The commonest site of injury is the lower limbs ^{1, 6, 7}.

This case introduces a previously undescribed mode of burn injury associated with e-cigarettes, which initially manifested as sudden onset chest pain.

Case Report

We present the case of a 60-year-old male who was referred by his GP to the Emergency Department (ED) with a full thickness burn of the left breast. (Figure 1)



Fig 1: Presentation with full thickness burn of left breast at 10 days post injury.

Ten days previously, the patient presented to another hospital, complaining of acute left sided chest pain of several hours' duration. When he was asked to loosen his shirt in the ED for clinical assessment and the placement of ECG leads, he noted a wound on his left breast and that his shirt was wet in the same area. Once his clothing had been fully removed the pain eased and the diagnosis of a burn wound was confirmed. On further questioning it was determined that the patient had been carrying an e-cigarette in his left breast pocket. It had inadvertently activated, and the e-liquid had leaked from the device causing a burn. The integrity of the e-cigarette was otherwise intact. Cardiac investigations were unremarkable. He was discharged with simple dressings to the care of his GP.

The wound deteriorated over subsequent days and he was referred to our centre for further management. We diagnosed a full thickness burn of 0.3% TBSA. We tangentially excised the wound and resurfaced using a split thickness skin graft from the left thigh, under combined general and local anaesthesia, the day following admission to hospital. On review at 4 weeks post-operatively, both the chest and donor wounds had healed fully. (Figure 2)



Fig 2: Healed split skin graft reconstruction of wound at 4 weeks post-operatively.

Discussion

The findings of the 2019 Healthy Ireland survey suggested the use of e-cigarettes in Ireland is rising⁸. However, in the absence of long term data relating to their side-effects, their use as an aid to smoking cessation in Ireland is not endorsed by the Health Service Executive⁹. Furthermore, regulation of these devices does not fall under the remit of the Health Products Regulatory Authority, which makes safety assurance difficult.

The composition of e-cigarettes explains the most commonly described mechanism of burn associated with their use. An e-liquid is vaporised through the generation of high temperatures, by a heating element, of up to 250 C and this is inhaled through a reusable mouthpiece. This process is initiated by switching the e-cigarette “on” and it is powered by a rechargeable lithium battery.

Previous reports have postulated that a “thermal runaway” exothermic malfunction of the lithium battery, often as a result of exposure to moisture or contact with metal, can lead to overheating and secondary explosion⁷. Equally, a short-circuit within the battery can cause it to overheat⁷. We are unclear, due to his delayed presentation, of the exact mechanism of injury to our patient, however given he noted an egress of the e-liquid onto his shirt and the e-cigarette was in the “on” mode, it was likely the result of a fault in the product and a mixture of both chemical and thermal burns. He also received no first aid and as he did not perceive his symptoms to be the result of a burn injury, the contact time with the inciting agents was prolonged. This likely contributed to a more severe - albeit small - full thickness injury. This case, therefore, demonstrates an additional danger of e-cigarettes not previously described.

This report demonstrates potential pitfalls of e-cigarette use, exclusive of the known effects of nicotine and, yet, unknown effects of their additional constituents. We caution patients regarding the transport of e-cigarettes, especially when the risk exists of direct contact of components with skin. In this regard we echo the sentiments of Treitl et al who suggest the use of an insulated protective case¹⁰.

Declaration of Conflicts of Interest:

The authors of this paper declare no conflicts of interest.

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