

Exploding power: A NSW Statewide review

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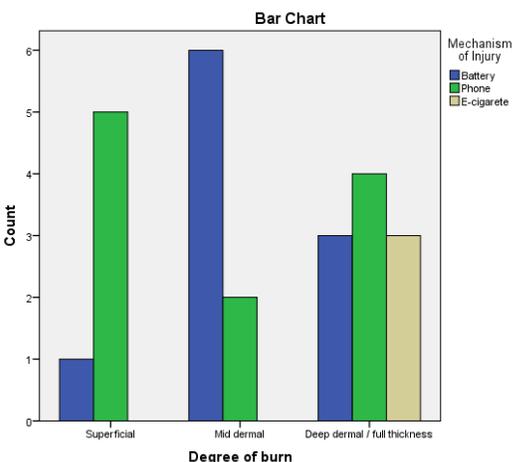
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INTRODUCTION

Lithium battery can lead to spontaneous thermal reactions from short circuiting creating an exothermic reaction resulting in partial and full thickness injuries.

A retrospective audit was conducted across the three large burn centres in New South Wales for lithium battery explosions from 2005 – 2019.

Lithium batteries do not explode. An explosion can occur when a lithium battery is being used to power a device. The cause of this explosion is a short circuit of the electrical wiring outside of the battery, which leads to an exothermic reaction triggering the battery breaking down the barrier between the cathode and the anode (usually made of plastic) and then a fire occurs.



High-quality batteries have a venting system which will not stop the fire but will prevent the "explosion" whereas cheaper batteries made without proper controls do not have these vents.

"Thermal runaway" can only occur when there are multiple batteries. As one catches fire the heat is transferred to its neighbour creating a domino effect. Most devices only have 1 lithium battery (iphoneX has 2). The Samsung Galaxy, in a quest to stay as small as possible, had the circuit board against the battery (a design flaw).

The explosive results

There were 24 patients whom suffered burn injuries from lithium battery devices across the three large burn centres in New South Wales.

- Average age was 28.96 years +/- 16.61 SD ranging from 1 to 58 years.
- Average TBSA was 2.5% (0.1 – 21%).
- The most common mechanism was from phone batteries (n=11), portable batteries (n=10), and e-cigarettes (n=3).
- Men were more affected than females. [n=21; n=3].
- First aid was adequate in 58.3% of cases.
- The degree of burn injury ranged from: superficial (n=6), mid dermal (n=8), deep full thickness (n=10).
- The lower limb region was the most affected region (n=9), followed by upper limbs and a combination of both (n=6 respectively).
- Most patients were seen in an outpatient setting (n=21), however 3 had extended lengths of stays.
- 17 of these cases were non operative. The remaining had split thickness skin grafts (n=5) or xenograft (biobrane) applied (n=2).
- One case had a complication of infection which required multiple operations and extended length of stay.
- A chi-square test of independence was conducted between device of injury and degree of burn. There was a statistically significant association between device of injury and degree of burn, $\chi^2(4) = 10.233$, $p = 0.04$, Cramer V = 0.462.

- ❑ There is no international consensus or regulation of these devices. There is a need for manufacturers to provide clear instructions about safe use regarding electrical standards.
- ❑ Future consideration regarding thermal cut offs, overcharge protection and overpressure relief mechanisms will need to be considered.
- ❑ The majority of the patients attend outpatient settings. Outpatient education on device use with thermal risk should be implemented.
- ❑ International regulation on the risks associated with e-cigarettes is growing with its increased injuries and associated respiratory compromise.

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