



Thermal Blast Injury in Child: A Case Report and Review of Literature

Authors

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Abstract

Thermal Blast Injuries due to explosion of a batteries are rare and life threatening. This low voltage batteries are not free from danger as they can be easily accessed by children. If mishandled, it can lead to serious adversities but can be prevented by proper education and counseling of the parents and children. An exceptionally rare and peculiar mode of Thermal Blast injury in a child as a result of battery explosion is reported here. This case report emphasizes the need for education to parents in handling low voltage batteries.

Key Words: *Thermal Blast Injury, Battery Explosion, Low Voltage.*

Introduction

Low-voltage battery injuries are relatively uncommon. Injury caused by flow of heavy current due to short-circuiting a low-voltage battery has not been described in the literature.

We present a child who suffered Thermal Blast Injury due to short circuiting of wires connected to low voltage batteries. It was a rare and peculiar mode of injury from a source commonly perceived to be harmless to anyone. Extensive life threatening injuries can be caused by a simple device such as a 9 v dry cell battery. The management of the resultant tissue devastation in

a scarce resource economy can be quite challenging. Early surgical intervention offers the best hope for complete recovery.

Case Report

Two siblings, aged 12 yrs and 10 yrs found a battery in school amidst the stones. It was a dry Alkaline Battery made of Zinc-Manganese Dioxide (Zn/MnO_2) with a Voltage of 9.0 volts. They connected this battery with a wire to a switch board, following which there was a short circuit resulting in a blast and thus inflicting a rare Thermal Blast burn injury in child. There was

no complaints of difficulty in breathing, loss of consciousness, convulsions, altered sensorium, numbness, tingling, disturbances in vision and hearing, following explosion. On examination, both the siblings were conscious, vitals were stable. The younger sibling received no injuries.

The elder one had multiple, small superficial to deep punctated burns with bleeding over chest, neck and left arm (Fig.1). There was no entry or exit wound. Physical examination was within normal limits.



Fig.1 Showing Thermal Blast Injury on Chest

Airway Breathing and Circulation were monitored. X-Ray lateral view of the Neck showed metal pieces in suprasternal area penetrating the strap muscles (FIG-2). USG abdomen was normal, Otoscopy and ophthalmoscopic examination revealed no

abnormality. Intravenous fluids, antibiotics, analgesics were started. Tetanus prophylaxis was given. Debridement surgery was performed under general anesthesia. Postoperative period was uneventful. Child was admitted for two weeks and discharged on recovery (FIG.3).



Fig.2 X-Ray lateral view of the Neck showing Metal Pieces.



Fig.3 Showing Postoperative picture of recovery

Discussion

A Blast Injury is a complex type of physical trauma resulting from direct or indirect exposure to an explosion^[1]. Blast injuries occur with the detonation of high-order explosives as well as the deflagration of low order explosives. These injuries are compounded when the explosion occurs in a confined space. Blast injuries are divided into four classes: primary, secondary, tertiary and quaternary.

Primary injuries are caused by blast overpressure waves or shock waves. These are especially likely when a person is close to an exploding munition, such as a land mine.^[2]

Thus, the majority of prior research focused on the mechanisms of blast injuries within gas-containing organs/organ systems such as the lungs, while primary blast-induced traumatic brain injury has remained underestimated. *Blast lung* refers to severe pulmonary contusion, bleeding or

swelling with damage to alveoli and blood vessels, or a combination of these.^[3] It is the most common cause of death among people who initially survive an explosion.^[4]

Secondary injuries are caused by fragmentation and other objects propelled by the explosion.^[5] These injuries may affect any part of the body and sometimes result in penetrating trauma with visible bleeding. At times the propelled object may become embedded in the body, obstructing the loss of blood to the outside.

Injuries resulting from this type of traumatic impact are referred to as tertiary blast injuries. Tertiary injuries may present as some combination of blunt and penetrating trauma, including bone fractures and coup contre-coup injuries. Young children, because they weigh less than adults, are at particular risk of tertiary injury.^[5]

Quaternary injuries or other miscellaneous named injuries, are all other injuries not included in the

first three classes. These include flash burns, crush injuries and respiratory injuries.^[5] Traumatic amputations quickly result in death, and are thus rare in survivors, and are often accompanied by significant other injuries.^[5,6]

Mechanism of Explosive Blast Injury

Blasts are characterized by the release of large quantities of energy in the form of pressure and heat, with the exact amount depending on the type and amount of explosive. If the explosion is confined within some sort of casing such as a bomb, the pressure will rupture the housing and eject the resulting fragments at high velocity. The remaining energy is transmitted to the surrounding environment in the form of a blast wave, blast winds, ground shock, and fire.^[7]

Battery explosions can occur when a battery is misused or malfunctions. Some leading causes for battery explosions may include attempting to recharge batteries that are not rechargeable, short circuiting a battery, overcharging a battery, recharging a battery too quickly and disposing of the battery in a fire.

Any of these actions may cause a battery to build up pressure inside its walls, leak, or can otherwise damage the structural integrity of the battery. People who are injured in an explosion or fire-related accident may suffer burn injuries as a result of the incident.

Management of the burns patient involves immediate care of the airway, breathing, circulation and fluid resuscitation. Local care depends on the degree of burns and ranges from local application of antibiotics to surgical debridement and escharotomy or fasciotomy.

Battery explosions can be fatal. It should be ensured that they are not easily accessible to the children. Parents and children should be educated regarding the hazards of mishandling the battery. Alertness awareness on part of the parents and community can prevent such casualties.

Umesh Kumar Bhadani et al described orofacial blast injury in a fifteen year old boy due to short circuiting of wires connected to a 12 volt car battery while peeling off insulation with the intent of running of musical instrument.^[8]

In our patient the thermal blast injury occurred because of 9 volt dry alkaline battery which is caused by flow of heavy current due to short-circuiting a low-voltage battery has not been described in the literature.

Our child recovered completely after prompt medical and plastic surgery treatment.

Conclusion

It is common for pediatric age group to do maneuvers in ignorance which can prove dangerous causing fatal injury. A small lapse in precaution can lead to serious thermal blast injury by battery considered to be harmless otherwise. The present case emphasizes the need of proper education and counselling of parents about proper handling of low voltage electric source like battery.

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