**CASED-BASED REVIEW**

**A Medicolegal Perspective on the Development of Facial Hypertrophic Scars in a Child after Contact with Alkaline Battery Content**

**Running Head**

Hypertrophic Scar Due to Battery Contact

(\*)The case reported in this article was presented orally in Turkish at the 15th Forensic Sciences Congress and its 145-word abstract was published in the congress summary book. The case was treated in Department of Plastic and Reconstructive Surgery and was evaluated in Department of Forensic Medicine of Medical Faculty of Van Yuzuncu Yil University.

**Canser Yilmaz DEMIR,** MD.,Associate Professor of Plastic and Reconstructive Surgery, Head of the Department of Plastic and Reconstructive Surgery,Medical Faculty of Van Yuzuncu Yil University, Van, Turkey. E-mail: [canser23@hotmail.com](mailto:canser23@hotmail.com) ORCID: 0000-0002-6715-6515

**Mahmut ASIRDIZER,** MD.,Professor of Forensic Medicine. Head of the Department of Forensic Medicine, Medical Faculty of Bahçeşehir University, Istanbul-Turkey. E-mail: [masirdizer@yahoo.com](mailto:masirdizer@yahoo.com) ORCiD ID: 0000-0001-7596-5892

**Yavuz HEKIMOGLU**, MD., Associate Professor of Forensic Medicine. Clinic of Forensic Medicine, Republic of Turkey Ministry of Health Ankara City Hospital, Ankara, Turkey. Email: [evisim@gmail.com](mailto:evisim@gmail.com) ORCID: 0000-0001-9990-6045

**CORRESPONDING AUTHOR:**

**Prof. Dr. Mahmut Asirdizer.** Head of Department of Forensic Medicine, Medical Faculty of Bahcesehir University, Sahrayıcedid Mahallesi, Batman Sk. No: 66–68. 34734. Yenisahra / Kadıköy, Istanbul - Turkey. E-mail: [masirdizer@yahoo.com](mailto:masirdizer@yahoo.com)

**Facial Hypertrophic Scar Development in a Child Following Contact to Alkaline Battery Content**

**Abstract**

***Introduction:*** Previous articles frequently reported cases of mucosal burns, ulcers, and necrosis caused by disc or button-shaped batteries swallowed or inserted into cavities such as the nose, eyes, ears, vagina, and even open wounds. Similarly, there are case reports in the literature on skin burns caused by the explosion of a mobile phone battery. However, only one case of skin burn caused by direct skin contact with the contents of the battery was reported.

***Case Report:*** A four-year-old boy was the subject of the current case report. He was inspired by a movie hero (Rambo) and painted his face with the contents of an alkaline battery, resulting in serious chemical facial burns. About ten months after the incident, the boy was sent to the Forensic Medicine Department to determine the cause of the injury following were treated the hypertrophic scars on his face by the Plastic and Reconstructive Surgery Department.

**Conclusions:** Based on this case report, In this article, the risks that batteries pose to kids were described, attention was drawn to potential medicolegal problems with these injuries, and safety measures can be employed to protect children from these dangers were addressed. In this context, it was emphasized how important it is to have child-friendly warnings on batteries.

**Key words:** Chemical Burns; Scars, Hypertrophic; Legal Liability.

**1. Introduction**

Many toys and electronic devices that are frequently used in daily life do not have locked battery beds, despite the fact that some manufacturers lock the battery beds of toys and electrical devices by screwing them in a way that only adults can access. Additionally, negligent parents occasionally leave batteries in areas where kids can easily access them. These easily accessible batteries pose a serious risk of harm and even death to young toddlers who frequently put their finds in their mouths and to older kids who are more likely to shatter them while curious about what’s inside **(1-3)**.

Small-sized disc, button, or pen batteries can be swallowed, and this has been widely reported in the literature. After ingesting batteries, the active components may dissolve in the upper digestive system, causing severe mucosal burns and necrosis **(2-4)**.

The batteries cause a significant exothermal response in the tissue after ingestion due to the dissolution of the active ingredients, resulting in severe mucosal burns and necrosis **(2,4,5)**. Although uncommon, it has been reported that swallowing batteries can result in heavy metal toxicity, including lithium and mercury **(6,7)**, as well as vocal cord paralysis **(8-10)**, trachea-oesophageal fistulas **(1,11-20)**, aorta-esophageal fistulas **(8)**, ulcerative esophagitis **(21)**, stomach mucosal erosions and ulcerations **(4)**, and rupture of Meckel’s diverticulum **(22),** though they were seen uncommon. Some of the findings that may indicate toxicity following oral ingestion of batteries is the presence of symptoms including chest or stomach discomfort, nausea and vomiting, diarrhea, hematemesis, and melena **(6)**. It has been reported in the literature that complications and poisonings due to battery ingestion can result in death under some circumstances **(20,23,24)**.

The largest series on battery ingestion in the literature reported that 2,382 children were hospitalized after swallowing 2,320 disc or button-shaped batteries and 62 small cylindrical batteries, but only 9.9% of the children had symptoms **(2)**. In 112 children with an average age of 3 years who were admitted to healthcare facilities after ingesting button batteries in UK, 25% of the batteries were detected in esophagus, 58% in stomach, 2.7% in duodenum, 4.5% in small intestine, 5% in esophagus, and 8% in large intestine **(24)**.

It has also been stated in the literature that children have inserted small batteries into their nose **(5, 25)**, ears **(5)**, vagina **(26,27)**, eyes **(28)**, and open wounds **(29)**, causing burns, ulcerations, and necrosis. Severe flame burns caused by mobile phone battery explosions are another type of injury associated with batteries **(30)**. A 10‑year‑old boy was joining three commonly available pencil batteries in series and twisting the wire with his teeth when one of the batteries exploded causing severe injuries to his midface and mandibular region **(31).**

However, only one case of chemical skin burns caused by direct contact with battery contents has been reported in the literature **(32)**.

The aims of this article are to increase public awareness of the risks that batteries pose to children as due to this uncommon case report, to drawn attention to potential medicolegal problems with these injuries, and to discuss the safety measures that might be implemented to protect kids from these risks.

**2. Case Report**

A four-year-old child at home removed the battery from the TV remote control, smashed it with a hammer, and painted his face with the black substance in the battery. The child’s parents eventually discovered the paint on his face when he started to cry, and took him to the hospital. Doctors at the hospital detected chemical burns on the boy’s face and started treating the burn immediately. The child was referred to the plastic and reconstructive surgery department of a university hospital when hypertrophic scars started to form on the child’s face 10 months after the incident. Physical examination revealed hypertrophic scars that were enlarged from the skin and red in color on both the right and left sides of the child’s face **(Figure-1)**. In the course of medical treatment, the patient received a single intralesional dose of triamcinolone acetonide. After taking medical treatment for his injuries, the kid was sent to the Forensic Medicine Department to determine the cause of the injury and to determine whether there was child abuse or neglect in his injury.

E:\YAYINLAR\001- DEVAM EDEN YAYINLAR\EVRE-0 PROJE AŞAMASINDA  ATIL KALANLAR\Demir CY., Alkaline Batteries [TAP]\Figure-1.tif

**Figure-1:** Burn Scars on Face of the Child 10 Months after Contact by the Alkaline Battery Content.

When the child was questioned about why he had used the battery contents to paint his face, he responded, “I painted my face black like Rambo because I saw the hero in the movie paint his face black”. When asked what kind of battery was used in the TV remote control, the child’s parents showed an AAA medium alkaline cylindrical battery.

The broken battery had warnings written on it in small writing in either English or the language of the nation from which it was imported, as well as the image “do not throw in the trash”. On the battery, there was no Turkish warning. The package this battery could not subject to examination because it was thrown.

*In accordance with the 1964 Declaration of Helsinki and its subsequent revisions or equivalent ethical norms, informed consent was obtained from the child's legal guardian, the father, for publishing the information and photographs included in this case report for scientific purposes.*

**3. Discussion**

In the current case, the boy was inspired by the television movie “Rambo”, so he destroyed the batteries with a hammer and painted his face with black material in the battery to mimic Rambo. It is reported that children, especially under the age of eight, frequently mimic the heroes they see and idealize in settings like television and video games. While these imitations help children's imaginations develop, they can also lead to risky activities like children who believe they are “Superman” jumping from heights. Parents should be extremely attentive and take every precaution to monitor their children’s developmental processes throughout this time to ensure that they are not damaged **(33)**. As in the case at hand, determining whether a kid’s injury was intentionally brought on by child abuse or neglect or unintentionally brought on by an accident is one of the most crucial forensic medical problems.

Delay in hospital admissions, the child being transferred from one hospital to another, bringing the child to the emergency room, typically in the evening, the presence of statements in the history that conflict with the physical findings, the presence of attempts by the child’s parents to place blame on someone other persons, having more than one suspected trauma history for various injuries, finding out that the child's parents were maltreated as children, and realizing that parents and kids have unrealistic expectations will provide important clues for diagnosis of child abuse. The presence of many wounds that occurred in different parts of the body and at different times, which is tried to be explained by a single reason, coexistence of different types of lesions in the person's body, the fact that the wounds in the child were tried to be hidden by the parents, are defined as pathognomonic physical findings that indicate that the child has been exposed to violence previously or systematically **(34)**. Based on the anamnesis and physical examination findings, it was determined that the injury did not occur as a result of child abuse in the current case, and the evaluation of negligence was left to the court’s discretion.

Winek et al. described a thigh skin burn in a two-year-old boy in 1999, which was initially suspected to be child abuse before being attributed to the leaking of defective alkaline batteries. The strong alkaline solution that had leaked from damaged batteries in a CD player had accumulated in the car seat and was then absorbed by the victim’s trousers when the victim was seated and this resulted in a third-degree chemical burn on the child’s thigh. They conducted a series of chemical analyses on the child’s trousers decided that injury was accidental **(32)**.

Within the context of family law, civil law, and criminal law of the Turkish legal system, the family’s responsibilities to care for, educate, and support the child are clearly stated, and sanctions for violations of these responsibilities are defined in the Turkish Penal Code **(34,35)**. According to Turkish Penal Code Article 233/1, anyone found responsible for neglect of a legal duty to care for, educate, or support another person may receive a complaint-based penalty of up to one year in prison **(36).**

The damaged battery did not have any warnings labeled in Turkish, like many other batteries on the market. On the other hand, it was observed that many battery packs on the market had small print instructions in various languages, including Turkish. There were no warnings on the batteries or battery packs that were particularly easy for kids who are illiterate to understand. According to the Turkish Consumer Protection Law and the Promotion and User Guide Regulation, all goods within the scope of these legislations used in the country must be put on the market with Turkish “introductory and user manuals” along with written and audible warnings in Turkish **(37)**. On the European Union’s Consumer Rights web page, it is also emphasized that “the contracts must be clearly written and should not contain unfair terms of contract” **(38)**. Manufacturers and importers can be subject to penalties and compensation if the warnings on the batteries and battery packets they manufacture or import do not meet the requirements mentioned in these legal regulations.

We believe that the precautions outlined below can help to prevent battery-related injuries in children; 1) Installing child locks on the battery beds of toys, television remote controls and similar electronic devices that use batteries before the manufacturers are allowed to place them on the market; 2) Placing prominent notices on the batteries in the language of the country where the product is marketed, and child-friendly notices as shown in **Figure-2**; 3) Educating pre-school and primary school students and their families about the proper use of batteries, their dangers, and what to do if they come into contact, as well as raising public awareness through television public service announcements.

**E:\YAYINLAR\001- DEVAM EDEN YAYINLAR\EVRE-0 PROJE AŞAMASINDA  ATIL KALANLAR\Demir CY., Alkaline Batteries [TAP]\Figure-2.tif**

**Figure-2:** An Example of a Warning with Native-Language (Turkish) and English Texts and Child-Friendly Illustrations, which were Recommend Placing on Batteries and Their Packaging.

**4. Conclusion**

Contact between children and batteries can sometimes result in serious injury, illness, or even death. It is very important for parents to be more vigilant under the supervision of their children and the simple precautions mentioned above are very important to prevent the life-threatening harms caused by batteries in children.

Concomitantly, by taking these simple measures, parents and businesses can avoid potential criminal penalties and compensation obligations.

**References:**

1. Anand TS, Kumar S, Wadhwa V, Dhawan R. Rare case of spontaneous closure of tracheo-esophageal fistula secondary to disc battery ingestion. Int J Pediatr Otorhinolaryngol. 2002;63(1):57-9.
2. Litovitz T, Schmitz BF. Ingestion of cylindrical and button batteries: an analysis of 2382 cases. Pediatrics. 1992;89(4 Pt 2):747-57.
3. Kurkcuoglu IC, Eroglu A, Tekinbas C, Karaoglanoglu N. Accidental ingestion of alkaline battery in children. Turkish J Thorac Cardiovasc Surg. 2003;11(3):193-194.
4. Lee JH, Lee JH, Shim JO, Lee JH, Eun BL, Yoo KH. Foreign body ingestion in children: should button batteries in the stomach be urgently removed? Pediatr Gastroenterol Hepatol Nutr. 2016;19(1):20-8.
5. Thabet MH, Basha WM, Askar S. Button battery foreign bodies in children: hazards, management, and recommendations. Biomed Res Int. 2013; 2013: 846091.
6. Mallon PT, White JS, Thompson RL. Systemic absorption of lithium following ingestion of a lithium button battery. Hum Exp Toxicol. 2004;23(4):193-5.
7. Bass DH, Millar AJ. Mercury absorption following button battery ingestion. J Pediatr Surg. 1992;27(12):1541-2.
8. Hamilton JM, Schraff SA, Notrica DM. Severe injuries from coin cell battery ingestions: 2 case reports. J Pediatr Surg. 2009;44(3):644-7.
9. Bernstein JM, Burrows SA, Saunders MW. Lodged oesophageal button battery masquerading as a coin: an unusual cause of bilateral vocal cord paralysis. Emerg Med J. 2007;24(3):e15.
10. Patel SA, Hillel AD, Perkins J. Battery ingestion leading to bilateral vocal cord paresis. JAMA Otolaryngol Head Neck Surg. 2013;139(3):304-6.
11. Shabino CL, Feinberg AN. Esophageal perforation secondary to alkaline battery ingestion. JACEP. 1979;8(9):360-3.
12. Sigalet D, Lees G. Tracheoesophageal injury secondary to disc battery ingestion. J Pediatr Surg. 1988;23(11):996-8.
13. Chiang MC, Chen YS. Tracheoesophageal fistula secondary to disc battery ingestion. Am J Otolaryngol. 2000;21(5):333-6.
14. Okuyama H, Kubota A, Oue T, Kuroda S, Nara K, Takahashi T. Primary repair of tracheoesophageal fistula secondary to disc battery ingestion: a case report. J Pediatr Surg. 2004;39(2):243-4.
15. Grisel JJ, Richter GT, Casper KA, Thompson DM. Acquired tracheoesophageal fistula following disc-battery ingestion: can we watch and wait? Int J Pediatr Otorhinolaryngol. 2008;72(5):699-706.
16. Imamoğlu M, Cay A, Koşucu P, Ahmetoğlu A, Sarihan H. Acquired tracheo-esophageal fistulas caused by button battery lodged in the esophagus. Pediatr Surg Int. 2004;20(4):292-4.
17. Alkan M, Büyükyavuz I, Doğru D, Yalçin E, Karnak I. Tracheoesophageal fistula due to disc-battery ingestion. Eur J Pediatr Surg. 2004;14(4):274-8.
18. Petri NM, Mestrović J, Andrić D, Krzelj V, Stipancević H. Esophagotracheal fistula after lithium disc battery ingestion successfully treated with hyperbaric oxygen therapy. Int J Pediatr Otorhinolaryngol. 2003;67(8):921-6.
19. Van Asperen PP, Seeto I, Cass DT. Acquired tracheo-oesophageal fistula after ingestion of a mercury button-battery. Med J Aust. 1986;145(8):412-5.
20. Blatnik DS, Toohill RJ, Lehman RH. Fatal complication from an alkaline battery foreign body in the esophagus. Ann Otol Rhinol Laryngol. 1977;86(5 Pt 1):611-5.
21. Marom T, Goldfarb A, Russo E, Roth Y. Battery ingestion in children. Int J Pediatr Otorhinolaryngol. 2010;74(8): 849-54.
22. Karaman A, Karaman I, Erdoğan D, et al. Perforation of Meckel's diverticulum by a button battery: report of a case. Surg Today. 2007;37(12):1115-6.
23. Soerdjbalie-Maikoe V, van Rijn RR. A case of fatal coin battery ingestion in a 2-year-old child. Forensic Sci Int. 2010;198(1-3):e19-22.
24. Paediatric Surgery Trainee Research Network. Magnet and button battery ingestion in children: multicentre observational study of management and outcomes. BJS Open. 2022;6(3):zrac056.
25. Guidera AK, Stegehuis HR. Button batteries: the worst case scenario in nasal foreign bodies. N Z Med J. 2010;123(1313):68-73.
26. Yanoh K, Yonemura Y. Severe vaginal ulcerations secondary to insertion of an alkaline battery. J Trauma. 2005;58(2):410-2.
27. Griffin K, Brent R, Vollenhoven B, Swanson AE. Vaginal burn from alkaline battery in an 8-year-old. J Pediatr Adolesc Gynecol. 2015;28(4):e99-100.
28. Khan Y, Maqsood S, Marpuri S, Bhermi S, Geh V. Rapid onset of severe ocular injury after exposure to a button battery. J AAPOS. 2014;18(6):600-1.
29. Moulton SL, Thaller LH, Hartford CE. A wound caused by a small alkaline cell (button battery) under a plaster cast: report of a case. J Burn Care Res. 2009;30(2):355-7.
30. Görgülü T, Torun M, Olgun A. A cause of severe thigh injury: battery explosion. Ann Med Surg (Lond). 2015;5:49-51.
31. Kumar V, Singh AK, Kumar P, Shenoy YR, Verma AK, Borole AJ, et al. Blast injury face: an exemplified review of management. Natl J Maxillofac Surg. 2013;4(1):33-9.
32. Winek CL, Wahba WW, Huston RM. Chemical burn from alkaline batteries--a case report. Forensic Sci Int. 1999;100(1-2):101-4.
33. Camurdan AD. Görsel medyanın çocuk sağlığına etkileri. STED. 2007; 16(2): 25-30.
34. Asirdizer M. Acil servislere başvuran çocuk ve kadın istismarı olgularına hekimlerin yaklaşımı Türkiye Klinikleri J Surg Med Sci 2006, 2(50):39-48.
35. Asirdizer M. Hekimlik ve Hukukun Kesişim Noktası: Tıbbi Hukuk. Google Books and Google Play, GGKEY: TLYC7H50EH9: E-Book, 2021.
36. Ozgenc I. Gerekçeli Türk Ceza Kanunu. Ankara: Seçkin Publication. 2004.
37. Arat A, Endes Selvi N. Tüketicinin Korunması Hakkında Kanun ve İlgili Yönetmelikler, 2. Baskı. Ankara: Seçkin Yayıncılık. 2022
38. Tepper PR. The Law of Contracts and the Uniform Commercial Code, 3rd ed. Australia: Cengage Learning. 2014.