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Case Report

Human Amniotic Membrane Dressing for a Female Case With Chemo-thermal Facial Burns Caused by Lithium-ion Battery Explosion: A Case Report

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ABSTRACT

Background: Lithium-ion battery explosions can cause mixed thermal and chemical injury. Facial involvement is especially challenging because edema, ocular risk, pain, and scarring must be addressed simultaneously. Human amniotic membrane (hAM) is a biologic dressing with scaffold, anti-inflammatory, and epithelial-supporting properties, but its use after a smartphone battery explosion has rarely been described. This case report describes the use of hAM in a case of facial chemo-thermal burn after a smartphone battery explosion.

Case Presentation: The case was a 17-year-old girl who sustained superficial partial-thickness burns involving approximately 8% of total body surface area after a smartphone exploded during charging. Her face, anterior neck, and both hands had been affected. Marked facial and periorbital edema prompted intensive care monitoring for 48 hours. Ophthalmologic examination was normal. The wounds initially received topical mupirocin. After edema subsided and burn depth was reassessed, hAM dressing was applied. Near-complete epithelialization with mild residual erythema was observed within five days, with minimal pain and no ocular or functional complications.

Conclusion: This case suggests that hAM may be a useful temporary biologic dressing for selected partial-thickness facial burns caused by lithium-ion battery explosion.

Keywords: Amniotic membrane, Chemo-thermal burn, Lithium-ion battery, Facial burn, Wound healing, Case report

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Highlights

- Lithium-ion battery explosion produced a mixed facial chemo-thermal burn in a female girl.
- hAM was used after reassessing the burn depth.
- Near-complete epithelialization was observed within five days after application.
- Further study of hAM for sensitive facial burns is needed.

Plain Language Summary

Rechargeable lithium-ion batteries can occasionally overheat or explode. When this happens, the injury may involve both heat and chemicals released from the battery. Burns to the face need special care because swelling can affect the eyes and airway, and scars can have a major effect on appearance and quality of life. A 17-year-old girl was presented in our study who was burned when a smartphone exploded while it was being charged. About 8% of her body surface was affected, including her face, the front of her neck, and both hands. Because her face and eyelids were very swollen, she was watched closely in the intensive care unit (ICU) for 48 hours. An eye specialist found no eye injury. For the first two days, the wounds were treated with an antibiotic ointment. After the swelling decreased and clinicians rechecked the burn depth, they covered the burn with a human amniotic membrane (hAM). Five days after application, the wounds were almost completely covered with new skin. Only mild redness remained. The patient reported no pain at that assessment, was satisfied with the appearance of her face, and had no recorded eye or movement problems. This experience suggests that hAM may be a useful dressing for selected shallow facial burns caused by battery explosions. However, this report describes only one patient, so it cannot prove that the membrane caused the rapid healing or that it is better than other dressings. Larger studies with standardized products and longer follow-up are needed.

Introduction

Lithium-ion batteries are widely used in portable electronics. When internal failure causes thermal runaway, rapid heat release, flame, hot fragments, and electrolyte leakage may produce combined thermal, chemical, and blast injury. Contemporary burn center series indicate that presentations related to lithium-ion devices are increasing and range from limited superficial injury to deep burns requiring excision and grafting [1-4]. Thermal injury can cause protein denaturation and coagulative necrosis, whereas alkaline or reactive electrolyte components can penetrate tissue and extend damage after the initial event. Consequently, burn depth may evolve, and serial examination is important [2, 5, 6]. Facial and periorbital injuries additionally require early airway and ophthalmologic assessment because edema and ocular exposure can threaten function.

Human amniotic membrane (hAM) is an avascular placental tissue composed of an epithelial layer, basement membrane, and stromal matrix. It has low immunogenicity and contains extracellular matrix components and signaling molecules associated with epithelial migration and inflammation control [7, 8]. Clinical studies and evidence syntheses in burn care have reported shorter healing time, fewer dressing changes, and reduced pain in selected partial-thickness wounds, although study quality, products, and processing methods vary [9-12]. This case report describes the use of hAM for a case with a facial chemo-thermal burn after a smartphone battery explosion. As a biologic dressing, hAM is thin, flexible, conformable to an irregular wound surface, semipermeable, and relatively low in immunogenicity; its collagen-rich basement membrane and stromal matrix can provide a protective scaffold that supports epithelial migration and a moist wound environment [7, 8, 13].

Case Presentation

The case was a 17-year-old female with no known previous medical condition who presented after a newly released branded smartphone exploded while being used during charging. Burns involved the face, anterior neck, and both hands, predominantly the right hand. Marked facial and periorbital edema was present on admission, and the patient was monitored in the intensive care unit for 48 hours. After edema subsided, examination showed

Figure 1. Facial and periorbital appearance of the burn case at presentation

superficial partial-thickness (superficial second-degree) burns involving approximately 8% of total body surface area (Figure 1). The wounds were erythematous and painful without documented blistering. Ophthalmologic assessment was normal.

During the first two days, mupirocin ointment and a conventional dressing were used. After two days of topical mupirocin, reduction of facial edema, and reassessment of burn depth, a hAM dressing with the required size was opened using aseptic technique and applied to the cleansed wound surface. We used ready-to-use, presterilized hAM dressings manufactured by AmiCare as temporary biologic wound coverings. The product is derived from human placental amnion and is processed and sterilized by the manufacturer before distribution. It is supplied in sealed sterile packaging and in dimensions selected to match the wound area. Manufacturer processing and terminal-sterilization parameters were not repeated at the treating center. It was covered with a sterile non-adherent secondary dressing and monitored clinically while epithelialization progressed. Near-complete healing was documented five days later. By day 5 post-hAM placement, the wounds were almost completely epithelialized, with mild residual erythema (Figure 2). The patient reported no pain at that time and was satisfied with facial appearance. No ocular or functional complication was documented.

Figure 2. Facial appearance of the case after treatment and near-complete epithelialization

Discussion

This study reported a rare but anatomically critical facial, neck, and hand burn case following smartphone-battery explosion. Rapid recovery was observed following initial topical antimicrobial care and subsequent hAM coverage. This observation is clinically relevant because lithium-ion battery injuries may combine thermal runaway, hot debris, and electrolyte exposure, and because facial burns prioritize tissue preservation and cosmetic outcome [1-4].

Published battery-related burn reports mainly describe irrigation, topical therapy, debridement, and, for deep injury, excision and split-thickness grafting. In our study, we managed a mobile phone explosion-induced burn with enzymatic debridement, whereas studies of larger-device and wearable-battery cases included full-thickness injury and operative treatment [2-4]. Direct comparison with these studies was not possible because of differences in device type, exposure, burn depth, and anatomic sites.

The biologic rationale for hAM includes a basement-membrane scaffold, low immunogenicity, and anti-inflammatory and antifibrotic signaling. Processing methods are not interchangeable and may alter cellular viability, matrix structure, mechanical behavior, or growth-factor retention [7, 8, 13]. In this study, a com-

mercially prepared, presterilized AmiCare hAM product was used; its processing and sterilization had been done by the manufacturer, not by the clinical team.

Evidence for hAM in cutaneous burns is encouraging but heterogeneous. A 2021 meta-analysis of 11 randomized clinical trials (RCTs) found benefits over several conventional comparators but emphasized the need for stronger trials [9]. An RCT comparing hAM with nitrofurazone-impregnated gauze reported faster epithelialization, lower pain, fewer dressing changes, and less early scarring [10]. A 2024 RCT comparing hAM with silver sulfadiazine similarly reported earlier epithelialization and lower pain, although its open-label design and specific lyophilized, irradiated product limit generalization [11]. A contemporary RCT protocol further illustrated the field's move toward standardized, traceable, in-hospital tissue-bank products [12].

The five-day clinical course in our patient is consistent with rapid healing of a superficial partial-thickness burn, and hAM may have supported a moist, protected wound environment. However, causation cannot be shown because there was no comparator, objective pain series, blinded wound assessment, or standardized scar follow-up. This report is therefore limited to feasibility and temporal association rather than treatment superiority.

This is a single case study with no control treatment. Burn depth was clinically assessed, and the source record did not include a validated serial pain score, objective epithelialized-area measurement, standardized scar scale, or long-term follow-up. The hAM dressing was ready to use and sterile; the treating team did not independently evaluate proprietary processing and terminal-sterilization parameters. The conclusion is therefore hypothesis-generating.

Conclusion

The hAM use was feasible as a temporary biologic dressing in a female adolescent with a superficial partial-thickness facial chemo-thermal burn caused by smartphone-battery explosion, with near-complete epithelialization observed within five days. The favorable course supports further prospective evaluation using traceable, standardized hAM products and longer scar and functional follow-up.

Ethical Considerations

Compliance with ethical guidelines

Under the policy of the treating institution, a single-patient case report does not require research ethics committee review or an ethics approval number. The report was prepared in accordance with applicable institutional requirements and the principles of the Declaration of Helsinki.

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Authors' contributions

Conceptualization, clinical care, and supervision: Mehdi Hojjati; Data collection and investigation: Amirsaleh Abdollahi; Investigation and writing the original draft: Sajjad Toofani; Supervision, and project administration, review and editing: Samira Sobhani; Final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

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