BRIEF RESEARCH REPORT

Emergency Medical Services

Burn patient decontamination outside of mass casualties

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Abstract

Objective: Decontamination protocols for victims of mass casualty events are well documented and emphasized to protect physicians, nurses and facilities. Decontamination practices outside of mass casualty events are unknown. This pilot study was undertaken to assess the current practices of burn patient decontamination outside of mass casualty events within level I and II trauma center emergency departments in the state of Michigan.

Methods: Using the Michigan Trauma Quality Improvement Project membership, a 10-question online survey was sent to trauma program managers at all level I and II trauma centers in Michigan. Survey questions focused on institutional decontamination protocols and consistency of use.

Results: Survey response was 50%. Of the responding facilities, 31% did not decontaminate burn patients. Of the centers who indicated that they did decontaminate burn patients, 31% did not follow a standardized protocol. Our survey revealed that 69% of facilities used a protocol for decontamination: 45% used the protocol consistently on all burns, and 55% at physician discretion. Products used most frequently to decontaminate burn patients included water (100%) followed by soap (44%).

Conclusion: This pilot survey of level I and II trauma centers in the state of Michigan revealed variability in the use of burn patient decontamination protocols and consistency of use. Additional research is warranted to determine if our results are reflective of trauma centers nationally.

KEYWORDS
burn patient decontamination protocols, chemicals, hazardous, secondary contamination

1  INTRODUCTION

1.1  Background

Decontamination of victims of mass casualty events is well documented and emphasized to preserve the safety of physicians and nurses as well as the integrity of the facility caring for these patients.1-4 Outside of the mass casualty scenario, the systematic routine decontamination of victims of chemical burns is also supported in the literature.4-6 However, evidence of consistent decontamination of patients burned by flame and thermal mechanisms appears to be lacking. Failure to decontaminate in these circumstances may exacerbate the patient’s injury as well as cause significant harm to physicians, nurses, and ancillary staff. In addition, the potential for secondary

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contamination impacting an emergency department or an entire hospital is a risk that could render an institution non-functional.\textsuperscript{1,2,7–10}

1.2 Importance

Structure and vehicle fires result in the breakdown of various materials such as plastics, foams, polyvinyl chloride, natural and synthetic fabrics, carpets, wood products, and asbestos-containing materials. Incomplete combustion of these materials causes many injurious chemicals to be released. Victims of these fires carry toxic substances on their clothing or skin while they are being transported and when they arrive at treatment facilities.\textsuperscript{11} Lack of routine and timely decontamination of burn victims may result in harm to patients, those providing care, and the institution.\textsuperscript{1,3,7–10}

1.3 Goals of this investigation

This pilot study was undertaken to assess the current practices of burn patient decontamination outside of mass casualty events within level I and II trauma center emergency departments in the state of Michigan. Responses to this initial survey will assist in developing an appropriate inquiry of practices nationwide.

2 METHODS

2.1 Design and setting

This descriptive pilot study was initiated at Bronson Methodist Hospital, a community level I trauma center in southwest Michigan with 550 activations per year. Our institution services a 10-county area with a population of \approx 800,000 people, providing 97,000 emergency department visits last year. The study was reviewed by the Western Michigan University Homer Stryker, MD School of Medicine Institutional Review Board and determined to not be human subject research.

We developed an online survey that was sent by the Michigan Trauma Quality Improvement Project (MTQIP) via Qualtrics. MTQIP is a statewide initiative with the goal of collaboratively sharing best practices and benchmarking data at level I and II trauma centers for the purpose of improving trauma care. Membership includes the trauma surgeon medical directors and program managers. The survey introduction and link were sent with the scripted invitation that read as follows: "The purpose of our survey is to clarify the role of decontamination in burn patients outside of mass casualty events. This includes thermal as well as chemical burns. We are defining decontamination as the process of removing or neutralizing hazardous substances from the patient. By definition, this process should occur in an isolated area prior to the patient being transported into the Emergency Department. In addition, all clothing is removed and the patient is washed or cleansed completely. We appreciate your participation in this short survey." Survey participation was voluntary and anonymous, with no remuneration to the membership of MTQIP.

2.2 Selection of participants

The invitation and survey were sent on 2 separate occasions, 20 days apart followed by a reminder 10 days later, to the trauma program managers of the 34 level I and II trauma centers verified by the American College of Surgeons in the state of Michigan. This included 10 level I and 24 level II trauma centers. The survey was sent directly to each program manager’s email associated with their MTQIP membership, which prevented duplication of responses from the same institution. Level III and IV trauma centers are not members of MTQIP, and therefore were not included in the survey. We did not stratify pediatric and adult trauma center responses.

2.3 Exposures

The survey asked if their trauma center treated and admitted burn patients, provided initial treatment only and transferred, or if burn patients were not seen or treated at their institution. We then asked if they decontaminated burn patients, and if the response was yes, the program managers were asked to indicate all types of burns they treated from a list that contained the following: flame, thermal, chemical, electrical, and other. The survey then queried if they have a standardized protocol for decontamination, and if so, does their facility use it consistently on all burn patients or at provider discretion. The survey then focused on products used to decontaminate burn patients and gave the choices of water, soap, antibacterial solution, baby shampoo, and other. Respondents were asked if their institution was American Burn Association verified and the approximate number of burn patients they treat per year with the choice ranges of 0–10, 11–30, and >30. Finally, the survey asked if they describe their institution as a university program, university affiliated, or a community program and their trauma center level of verification as designated by the American College of Surgeons.

2.4 Analysis

Qualtrics analytics were used to collect and organize the survey responses. Outcomes were summarized using descriptive statistics.
3 | RESULTS

The response rate to our survey by trauma program managers was 50%. Of the responding centers, 18% treated and admitted burn patients, 76% provided initial treatment and transfer burns, and one center did not see or treat burns. The majority decontaminated burn patients (69%). Burn decontamination practices by type of burn are shown in Figure 1. Our survey revealed that 69% of facilities used a protocol for decontamination: 45% used the protocol consistently on all burns, and 55% at provider discretion. Products used to decontaminate burn patients included water (100%), soap (44%), antibacterial solution (6%), and baby shampoo (6%).

The approximate number of burn patients treated per center in a year was 0–10 (38%), 11–30 (25%), and >30 (31%). One center in this survey indicated that they were an American Burn Association–verified burn center. One respondent identified as a university program, 75% identified as university affiliated, and 19% identified as community programs. Survey responses by trauma center level are displayed in Table 1.

4 | LIMITATIONS

Limitations to our study include the moderate response rate to our survey that was restricted to the 34 trauma centers in the state of Michigan, and thus may not accurately reflect the practices of all trauma centers. The inclusion of emergency physicians in our survey may have enhanced our understanding of decontamination practices. Weaknesses inherent in survey use include responses that may rely on recollection and not on verified data, questions that may be open to interpretation, and an inability to verify the accuracy of responses. Respondents may have modified their answers to avoid casting their institution in an unfavorable manner.

5 | DISCUSSION

This study provides an initial observation into the important process of burn patient decontamination outside of mass casualty events. Our survey of Michigan trauma centers indicated that burn decontamination is inconsistent in several aspects. Nearly one third of trauma centers in our survey did not decontaminate burn patients. Our survey revealed one third of the responding trauma centers do not use a decontamination protocol. Of the trauma centers who indicated that they did use a protocol, more than half followed the protocol only at provider discretion. This inconsistency can lead to contaminated patients being missed, thus placing physicians, nurses, ancillary staff and their institutions at risk for exposure to hazardous substances. Interestingly, our responses indicated that chemical burns were decontaminated at nearly 70%, whereas flame and thermal burns were decontaminated <30% of the time. This practice overlooks the harm that can be caused by the injurious products of incomplete combustion resulting from thermal and flame burns.

The mass casualty and military literature supports the systematic and organized decontamination of patients to mitigate the dangers of spreading harmful substances. Similar to burn patients involved in structure and vehicle fires directly benefit from the prompt removal of toxic or caustic substances on skin or clothing. The consistent practice of routine decontamination of all burn patients prevents exposure to clinicians, emergency department staff, and other patients. Two published reports document 3 cases in which burn patients involved in methamphetamine laboratory explosions caused the temporary shutdown of the emergency department for decontamination. In these cases, the secondary contamination also necessitated decontamination of the emergency department staff and transporting first responders. The disruption of having to shut down a portion or the entire emergency department directly impacts the care the institution is able to provide to the community, strains hospital resources, and is costly.

A profound clinical concern with decontaminating patients on arrival is the risk of clinical deterioration. Following the example of the mass casualty literature, protecting doctors, nurses, the staff and facilities should be a major priority. Decontaminating the burn patient who was not in a mass casualty event is essentially an extension of scene safety. Not unlike the donning of appropriate personal protective equipment in the current coronavirus disease 2019 pandemic, all those providing care must take the time to protect themselves before initiating treatment. Although this may pose some increased risk to the patient, it is far outweighed by the benefit of protecting the hospital and staff.

This initial survey of Michigan trauma centers exposes weaknesses in burn patient decontamination practices outside of mass casualty events that merit investigation on a broader scale. A national survey including emergency physicians, level I to IV trauma centers, and rural hospitals is needed. Exploring burn decontamination protocol use in special populations such as pediatric and geriatric patients should be incorporated.
### TABLE 1  Burn patient decontamination survey results

| Survey question                                      | Total no. (%) | Level I trauma center, n = 8 | Level II trauma center, n = 9 |
|------------------------------------------------------|---------------|------------------------------|------------------------------|
| I. Does your institution: (n = 17)                   |               |                              |                              |
| Treat and admit burns                                | 13 (76)       | 5                            | 8                            |
| Provide initial treatment only and transfer burns    | 1 (6)         | 0                            | 1                            |
| Burns are not seen or treated at our institution     |               |                              |                              |
| 2. Do you decontaminate burns: (n = 16)              |               |                              |                              |
| Yes                                                  | 11 (69)       | 6                            | (n = 8) 5                    |
| No                                                   | 5 (31)        | 2                            | 3                            |
| 3. If yes, which burns do you decontaminate: (n = 16)|               |                              |                              |
| Flame                                                | 4 (25)        | 4                            | 0                            |
| Thermal                                              | 11 (69)       | 6                            | 5                            |
| Chemical                                             | 2 (12)        | 2                            | 0                            |
| Electrical                                           | 1 (6)         | 1*                           | 0                            |
| Other                                                |               |                              |                              |
| 4. Do you use a protocol for decontamination: (n = 16)|               |                              |                              |
| Yes                                                  | 11 (69)       | 7                            | 4                            |
| No                                                   | 5 (31)        | 1                            | 4                            |
| 5. If yes, is the protocol used: (n = 11)            |               |                              |                              |
| Consistently on all burns                            | 5 (45)        | 4                            | 1                            |
| At provider discretion                               | 6 (55)        | 3                            | 3                            |
| 6. Products you use to decontaminate burns: (n = 16) |               |                              |                              |
| Water                                                | 16 (100)      | 8                            | 8                            |
| Soap                                                 | 7 (44)        | 3                            | 4                            |
| Antibacterial solution                               | 1 (6)         | 0                            | 1                            |
| Baby shampoo                                         | 1 (6)         | 0                            | 1                            |
| Other                                                | 0             | 0                            | 0                            |
| 7. Approximate number of burns treated per year:     |               |                              |                              |
| (n = 16)                                             | 6 (38)        | 2                            | 4                            |
| 0–10                                                 | 4 (25)        | 2                            | 2                            |
| 11–30                                                | 5 (31)        | 4                            | 1                            |
| > 30                                                 | 1 (6)         | 0                            | 1                            |
| No response given                                    |               |                              |                              |
| 8. American Burn Association verified: (n = 16)      |               |                              |                              |
| Yes                                                  | 1 (6)         | 1                            | 0                            |
| No                                                   | 15 (94)       | 7                            | 8                            |
| 9. Do you describe your institution as: (n = 16)     |               |                              |                              |
| University Program                                   | 1 (6)         | 1                            | 0                            |
| University Affiliated                                | 12 (75)       | 6                            | 6                            |
| Community Program                                    | 3 (19)        | 1                            | 2                            |

*a Other response: “Any concerns for additional exposure in all types of burns for example a flame burn that is suspected METH lab explosion.”

### 6  | CONCLUSION

This brief survey of level I and II trauma centers in Michigan revealed variability in the use of standardized burn patient decontamination protocols and their consistent application. The prevention of considerable harm to those rendering care and their facilities should be a priority. A nationwide survey is recommended to assess consistent protocol use in burn patient decontamination practices outside of mass casualty events.

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### CONFLICTS OF INTEREST

The authors report no conflicts of interest. The authors have no source of funding to report.

### AUTHOR CONTRIBUTIONS

All authors made substantial contributions to the study concept, design, data analysis, and manuscript drafting and editing. Scott B. Davidson takes the final responsibility of the article.

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