

Introduction

- In an interconnected world experiencing an escalation of conflict, dermatologists can play a pivotal role in the context of global warfare, particularly in the management and response to chemical attacks.
- In this study, we conduct a literature review to characterize the cutaneous manifestations of chemical warfare agents.

Background

- Agents, such as mustard gas, used in chemical warfare manifest cutaneously, resulting in skin-related injuries.
- The ability of dermatologists to recognize skin injuries as a result of exposure to chemical warfare agents enables prompt treatment to mitigate further harm.
- Being able to recognize the signs of biochemical attacks also strengthens public health readiness and response strategies.
- Although dermatologists should be critical initial responders in potential future chemical attacks, the infrequency of these incidents, coupled with insufficient education and training in this field, many feel unprepared for such responsibilities.

Methods

- Keyword searches in PubMed and Scopus were conducted to identify articles discussing the cutaneous manifestations of chemical warfare agents. MeSH search terms included “Chemical Warfare Agents” and “Skin”.
- Searches completed on November 17, 2023.

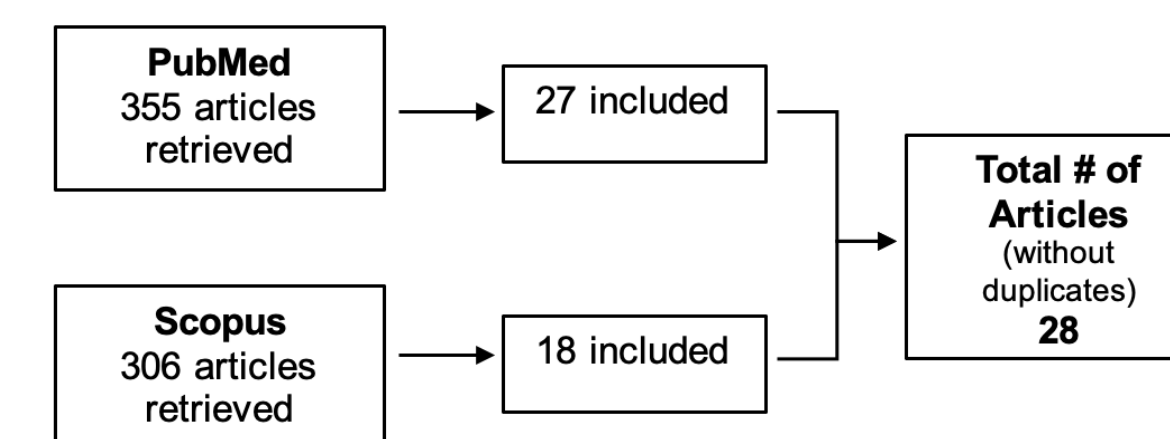
Inclusion Criteria

- Articles that discussed the cutaneous manifestations of chemical warfare agents

Exclusion Criteria

- Articles published more than 10 years ago
- Articles in languages other than English
- Articles within book chapters

Results



Chemical Agents Identified

- Sulfur Mustard
- Phosgene Oxime
- Lewisite
- Nitrogen Mustard

Table 1: Number of articles describing each chemical agent by database

Agent	# of articles on PubMed	# of articles on Scopus
Sulfur Mustard	20	12
Phosgene Oxime	4	4
Lewisite	3	2
Nitrogen Mustard	5	2
Other	3	3

*Other indicates articles that discussed additional agents, such as other alkylating, arsine, and halogenated oximes.

Table 2: Total number of articles describing each chemical agent

Agent	# of articles
Sulfur Mustard	21
Phosgene Oxime	4
Lewisite	3
Nitrogen Mustard	5
Other	3

*Other indicates articles that discussed additional agents, such as other alkylating, arsine, and halogenated oximes.

Table 3: Common manifestations described in literature

Agent	Common Manifestations
Sulfur Mustard	Erythema, itching, vesicles, bullae, burning, and blisters.
Phosgene Oxime	Urticaria, itching, erythema, edema, tissue necrosis, and blanching upon exposure. By 24 hours post-exposure, blanched skin becomes brown, followed by eschar formation.
Lewisite	Initial itching and stinging at exposure, followed by erythema and blistering.
Nitrogen Mustard	Edema, erythema, tissue necrosis, dermatitis, and hyperpigmentation.

Limitations

- The literature we reviewed includes fewer descriptions of cutaneous manifestations of nitrogen mustard exposure. Further literature reviews are needed to explore the most common manifestations of nitrogen mustard exposure.

Discussion and Conclusion

- Various cutaneous manifestations of chemical warfare agents have been characterized in the literature.
- Identifying these skin lesions is the first step to prepare in case of accidental or intentional chemical exposure.

References

1. Tewari-Singh N, Agarwal R. Mustard vesicating agent-induced toxicity in the skin tissue and silibinin as a potential countermeasure. *Ann N Y Acad Sci.* 2016;1374(1):184-192. doi:10.1111/nyas.13099
2. Nair A, Yadav P, Behl A, et al. Toxic blister agents: Chemistry, mode of their action and effective treatment strategies. *Chem Biol Interact.* 2021;350:109654. doi:10.1016/j.cbi.2021.109654
3. Singh SK, Klein JA, Wright HN, Tewari-Singh N. Phosgene oxime: a highly toxic urticant and emerging chemical threat. *Toxicol Mech Methods.* 2021;31(4):288-292. doi:10.1080/15376516.2020.1861670
4. Goswami DG, Agarwal R, Tewari-Singh N. Phosgene oxime: Injury and associated mechanisms compared to vesicating agents sulfur mustard and lewisite. *Toxicol Lett.* 2018;293:112-119. doi:10.1016/j.toxlet.2017.11.011
5. Tewari-Singh N, Goswami DG, Kant R, et al. Cutaneous exposure to vesicant phosgene oxime: Acute effects on the skin and systemic toxicity. *Toxicol Appl Pharmacol.* 2017;317:25-32. doi:10.1016/j.taap.2017.01.003