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Clinical and Medicolegal Evaluation of Inhalation Injury Cases in the Forensic Process

İnhalasyon Yaralanması Olgularının Adli Süreçte Klinik ve Medikolegal Açıdan Değerlendirilmesi

Emre Yuluğ[1], Demet Polat Yuluğ[2]

[1] MD, Forensic Medicine Specialist, Ministry of Health of Turkey Mersin City Hospital Mersin, Department of Forensic Medicine, Mersin, Turkey
[2] MD, Assistant Professor, Chest Diseases Specialist, Mersin University School of Medicine, Department of Chest Diseases, Mersin, Turkey

Öz

Amaç: Bu çalışmada, adli tıbbi değerlendirmeye yönlendirilen inhalasyon maruziyeti olgularının demografik, klinik ve medikolegal özelliklerinin retrospektif olarak değerlendirilmesi amaçlandı. Ayrıca klinik bulgular ve medikolegal sonuçların olay türü ve maruziyet paternine göre dağılımı incelendi.

Gereç ve Yöntem: Bu retrospektif, tek merkezli çalışmaya 2015–2025 yılları arasında belgelenmiş inhalasyon maruziyeti bulunan 47 adli olgu dahil edildi. Demografik, klinik ve medikolegal veriler retrospektif olarak değerlendirildi.

Bulgular: Olguların yaş ortalaması 30,7±14,5 yıl olup %59,6'sı erkekti. En sık olay türü iş kazası (%38,3), en sık maruziyet paterni ise biber gazıydı (%36,2). Olguların %78,7'si ilk değerlendirme sonrası taburcu edilirken %14,9'u yoğun bakım ünitesine yatırıldı. Hastane yönetimi, eşlik eden fiziksel yaralanma, radyolojik değerlendirme ve laboratuvar bulguları olay türü ve maruziyet paternine göre anlamlı farklılık gösterdi.

Sonuç: Adli sürece yansıyan inhalasyon maruziyeti olguları geniş bir klinik ve medikolegal spektrum göstermektedir. Klinik bulguların olay türü ve maruziyet paternine göre değişmesi, maruziyet özellikleri, klinik bulgular ve medikolegal kriterlerin birlikte değerlendirilmesini desteklemektedir.

Anahtar Kelimeler: İnhalasyon maruziyeti; adli tıp; biber gazı; duman inhalasyonu.

Abstract

Aim: This study aimed to retrospectively evaluate the demographic, clinical, and medicolegal characteristics of inhalational exposure cases referred for forensic medical evaluation. It also aimed to examine the distribution of selected clinical findings and medicolegal outcomes according to event type and exposure pattern.

Materials and Methods: This retrospective single-center study included 47 forensic cases with documented inhalational exposure between 2015 and 2025. Data were obtained through retrospective review of forensic reports and available medical records. Cases were assessed in terms of age, sex, event type, exposure pattern, degree of accompanying physical injury, radiological assessment, laboratory findings, hospitalization status, operation status, simple medical intervention status, and life-threatening condition. Appropriate statistical tests were used for group comparisons, and $p<0.05$ was considered statistically significant.

Results: The mean age was 30.7±14.5 years and 59.6% were male. Occupational accidents were the most common event type (38.3%), and pepper spray was the most common exposure pattern (36.2%). Most cases were discharged after initial evaluation (78.7%), while 14.9% required intensive care. Findings differed significantly according to event type and exposure pattern, particularly for hospital management, accompanying physical injury, radiological assessment, and laboratory findings.

Conclusion: Inhalational exposure cases show a broad clinical and medicolegal spectrum. Clinical findings varied according to event type and exposure pattern, supporting integrated assessment of exposure characteristics, clinical findings, and medicolegal criteria.

Keywords: Inhalational exposure; forensic medicine; pepper spray; smoke inhalation

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Sorumlu Yazar: Emre Yuluğ, M.D., Forensic Medicine Specialist, Ministry of Health of Turkey Mersin City Hospital Mersin, Department of Forensic Medicine, Mersin, Turkey
E-posta: kartalyulug@hotmail.com

INTRODUCTION

Inhalation injury is a heterogeneous clinical condition that may occur after exposure to smoke, toxic gases, vapors, fumes, or chemical irritants. Its clinical presentation ranges from transient mucosal irritation to severe respiratory compromise and systemic toxicity. In fire-related events, inhalation injury may involve upper airway thermal injury, lower airway and parenchymal chemical injury, and systemic toxic effects caused by combustion products such as carbon monoxide and cyanide (1-4). Early recognition is important because the severity of exposure may not always be fully reflected by the initial clinical appearance, and some patients may deteriorate after an apparently mild presentation (1,2).

Although inhalation injury is most commonly discussed in the context of burn care and smoke exposure, non-fire-related inhalational events are also encountered in routine clinical practice. These include occupational and domestic exposure to irritant or asphyxiant gases as well as interpersonal or law-enforcement-related exposure to pepper spray and similar chemical agents. While many of these cases are self-limited, previous studies have shown that clinically significant ocular, respiratory, and systemic effects may also occur depending on the type of agent, intensity of exposure, environmental conditions, and duration of contact (3,5-7). In addition, the clinical spectrum may be modified by accompanying trauma, exposure in enclosed spaces, delayed presentation, and pre-existing cardiopulmonary disease, making patient-based evaluation essential (2,5,8).

From an emergency medicine perspective, the initial evaluation of inhalation-related presentations may require rapid assessment of airway compromise, oxygenation status, toxic exposure, and the need for observation or hospitalization (1,3,8). In selected cases, further evaluation may also be required for associated burns, blunt trauma, or toxicological abnormalities. However, the significance of these cases is not limited to clinical management. When inhalational exposure occurs in occupational accidents, domestic incidents, assaults, or law-enforcement interventions, the event may also carry medicolegal implications. In such situations, documentation of the exposure context, accompanying physical findings, hospitalization, life-threatening condition, and need for medical intervention becomes important not only for patient care but also for forensic assessment.

Despite this dual clinical and medicolegal relevance, the literature has largely focused on burn-associated inhalation injury, smoke inhalation, and severe airway injury, whereas studies specifically addressing inhalational exposure cases reflected in the forensic process remain limited (1,2,8-10). In particular, relatively less is known about the distribution of such cases according to event type and exposure pattern, and about how these categories relate to hospitalization, intensive care requirement, laboratory or radiological abnormalities, and medicolegal outcomes in routine hospital practice. This gap is more evident in retrospective real-world datasets outside specialized burn units.

A clearer description of the demographic features, exposure patterns, clinical findings, and medicolegal outcomes of these cases may contribute to both emergency and forensic practice. Better characterization of these cases may support more consistent clinical assessment, improve documentation quality, and facilitate more accurate medicolegal interpretation in daily practice. Therefore, this study aimed to evaluate the clinical and medicolegal characteristics of inhalational exposure cases in the forensic process and to examine the distribution of selected clinical findings and medicolegal outcomes according to event type and exposure pattern.

MATERIALS AND METHODS

Study design and setting

This study was designed as a retrospective, single-center descriptive-analytical study evaluating the clinical and medicolegal characteristics of inhalational exposure cases referred to a forensic medicine outpatient clinic. The study included cases evaluated between January 1, 2015 and December 31, 2025 for whom a forensic medical report was issued and an inhalational exposure associated with the forensic event was documented.

Ethics

Ethics approval was obtained from the Non-Interventional Clinical Research Ethics Committee of a tertiary care training and research hospital (decision date: 25.02.2026; decision number: 137). The study was conducted in accordance with the principles of research and publication ethics and the Declaration of Helsinki.

Case identification and eligibility

A total of 32,640 forensic medical reports issued at the forensic medicine outpatient clinic between January 1, 2015 and December 31, 2025 were retrospectively screened. The electronic report archive was searched using exposure-related keywords including "pepper spray," "carbon monoxide," "smoke," "gas," and "inhalation." Records identified through this search were subsequently reviewed in detail to determine eligibility. Case identification was based on forensic medicine outpatient clinic records rather than hospital-wide diagnostic codes.

Cases were included if a forensic medical report had been issued and an inhalational exposure associated with the forensic event was documented in the forensic report or available medical records. Objective clinical, radiological, or laboratory evidence of respiratory tract injury was not required for inclusion. Accordingly, documented pepper spray exposures were also included even when objective respiratory injury was not demonstrated.

Cases were excluded when the available documentation was insufficient to confirm an inhalational exposure or when data required for the principal demographic, exposure-related, clinical, and medicolegal variables could not be obtained from the available records.

Study population and data collection

For eligible cases, forensic reports and available hospital records, including emergency department records, relevant clinical notes, laboratory results, and radiological reports, were retrospectively reviewed. Because of the retrospective design, only information documented in the existing records was evaluated.

The following variables were recorded for each case: age, sex, date of event, event type, exposure pattern, degree of accompanying physical injury, radiological assessment, laboratory findings, hospitalization status, operation status, simple medical intervention status, and life-threatening condition.

Definitions

Event type was classified into three categories: occupational accident, home accident, and interpersonal/law enforcement-related exposure. Exposure pattern was categorized into four groups: pepper spray exposure, irritant chemical exposure, toxic/asphyxiant exposure, and smoke/explosion-related exposure. Irritant chemical exposures included chlorine, ammonia, acid fumes, bleach/descaling-agent mixtures, ninhydrin, and similar occupational chemical irritants. Toxic/asphyxiant exposures included carbon monoxide, natural gas, fumigants, pesticides, and related toxic inhalational agents. Smoke/explosion-related exposures included documented inhalational exposure associated with fire, smoke, combustion, or explosion

events. Pepper spray exposures were classified separately because of their distinct exposure context and clinical characteristics.

Accompanying physical injury referred to physical injuries occurring in association with the forensic event, including burns or traumatic injuries, and was classified as no injury, cutaneous injury, internal organ injury, or combined injury. Transient ocular or cutaneous irritation attributable solely to the inhalational agent was not classified as an accompanying physical injury. Radiological assessment was categorized as not performed, performed with normal findings, or performed with abnormal findings, based on the available radiological reports in the medical records. Cases in which no radiological examination was performed were analyzed separately from those with normal radiological findings. Laboratory assessment was categorized as not performed, performed with normal findings, oxygen desaturation, elevated carboxyhemoglobin level, or other abnormal findings. Cases in which no laboratory investigation was performed were analyzed separately from those with normal results. Oxygen desaturation was assessed by pulse oximetry and defined as an SpO_2 value <90%. Carboxyhemoglobin levels were assessed by blood gas analysis.

Within the medicolegal evaluation, whether the injury was manageable with simple medical intervention and whether a life-threatening condition was present were determined according to the existing forensic medical reports and the 2019 Turkish guideline for the assessment of injury offenses under the Turkish Penal Code (20). These assessments had been performed as part of routine forensic medical evaluation rather than retrospectively for the purposes of the present study. Cases recorded as unspecified were retained as a separate category and were excluded from the relevant comparative analyses. For poisoning-related cases, life-threatening injury was assessed according to guideline-based criteria, including toxic blood concentrations when reliably established, severe impairment of consciousness, indications for intubation or cardiopulmonary resuscitation, need for extracorporeal elimination methods, major metabolic or blood-gas abnormalities, convulsions, severe hypotension, and clinically significant cardiac rhythm disturbances. For carbon monoxide poisoning, impaired consciousness at initial presentation, a COHb level >20%, requirement for hyperbaric oxygen therapy, and specific neurological or extra-neurological organ findings were additionally considered in accordance with the guideline. Hospitalization status was classified as discharge after initial evaluation, ward admission, or intensive care unit admission. Operation status was recorded as present or absent according to whether a surgical procedure was performed during the clinical course. The type and indication of surgery were additionally reviewed from the available medical records to determine whether the intervention was related to inhalational exposure itself, associated burns, or concomitant traumatic injury.

Outcomes

The primary aim of the study was to describe the demographic, clinical, and medicolegal characteristics of inhalational exposure cases. Secondarily, the distribution of selected clinical findings and medicolegal outcomes according to event type and exposure pattern was evaluated.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics for Mac, version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation or median (interquartile range), as appropriate, and categorical variables were presented as number and percentage. Age comparisons between groups were performed using the Kruskal–Wallis test. Because of the limited sample size and small expected cell counts in several categorical comparisons, Fisher's exact test

or exact tests were used as appropriate. Cases recorded as unspecified for simple medical intervention status or life-threatening condition were excluded only from the corresponding comparative analyses. A p value of <0.05 was considered statistically significant. Analyses were conducted at descriptive and univariable levels because of the limited sample size.

RESULTS

A total of 47 cases were included in the study. The mean age was 30.7 ± 14.5 years, with an age range of 5–67 years. Ten cases (21.3%) were younger than 18 years. Twenty-eight cases (59.6%) were male. Occupational accidents accounted for 18 cases (38.3%), home accidents for 12 (25.5%), and interpersonal/law enforcement-related exposures for 17 cases (36.2%). Pepper spray was the most common exposure pattern, observed in 17 cases (36.2%) (Table 1).

Most cases were considered manageable with simple medical intervention (37/47, 78.7%), whereas 9 cases (19.1%) were not; the status was unspecified in one case (2.1%). A life-threatening condition was present in 4 cases (8.5%), absent in 42 (89.4%), and unspecified in one case (2.1%). Regarding hospital management, 37 patients (78.7%) were discharged after initial evaluation, 3 (6.4%) were admitted to the ward, and 7 (14.9%) required intensive care unit admission. Surgical intervention was performed in 3 cases (6.4%). The surgical procedures were performed for associated burn injuries rather than for the inhalational exposure itself and included eschar excision, repeated eschar excision, grafting, and wound coverage procedures. Radiological examination was not performed in 37 cases (78.7%), was performed with normal findings in 7 (14.9%), and showed abnormal findings in 3 cases (6.4%). Laboratory investigation was not performed in 32 cases (68.1%), was performed with normal findings in 9 (19.1%), showed oxygen desaturation in 2 (4.3%), and elevated carboxyhemoglobin levels in 4 cases (8.5%) (Table 1).

Comparisons according to event type are presented in Table 2. Age distribution differed significantly among event types (p<0.001), with younger patients predominating in the home-accident group. Hospital management also differed significantly according to event type (p=0.006); all interpersonal/law enforcement-related cases were discharged after initial evaluation, whereas intensive care unit admission was observed in occupational and home accidents. Significant differences were also observed in accompanying physical injury (p=0.008), radiological assessment (p=0.009), and laboratory findings (p=0.024). In contrast, sex distribution, simple medical intervention status, life-threatening condition, and operation status did not differ significantly according to event type.

Comparisons according to exposure pattern are presented in Table 3. Hospital management differed significantly among exposure groups (p=0.028). Significant differences were also observed in operation status (p=0.002), accompanying physical injury (p<0.001), radiological assessment (p=0.004), and laboratory findings (p=0.002). Age, sex distribution, simple medical intervention status, and life-threatening condition did not differ significantly according to exposure pattern.

Table 1. General demographic, clinical, and medicolegal characteristics of the cases

Variable	Total (n=47)
Age, mean ± SD	30.7 ± 14.5
Age, median (IQR)	31.0 (21.0-38.0)
Age range	5–67 years

Table 1. General demographic, clinical, and medicolegal characteristics of the cases

Variable	Total (n=47)
Age <18 years	10 (21.3%)
Sex	
Male	28 (59.6%)
Female	19 (40.4%)
Event type	
Occupational accident	18 (38.3%)
Home accident	12 (25.5%)
Interpersonal/law enforcement-related exposure	17 (36.2%)
Exposure pattern	
Pepper spray	17 (36.2%)
Irritant chemical exposure	10 (21.3%)
Toxic/asphyxiant exposure	13 (27.7%)
Smoke/explosion-related exposure	7 (14.9%)
Accompanying physical injury	
No accompanying physical injury	26 (55.3%)
Cutaneous injury	18 (38.3%)
Internal organ injury	2 (4.3%)
Combined injury	1 (2.1%)
Radiological assessment	
Not performed	37 (78.7%)
Performed, normal	7 (14.9%)
Performed, abnormal	3 (6.4%)
Laboratory assessment	
Not performed	32 (68.1%)
Performed, normal	9 (19.1%)
Oxygen desaturation	2 (4.3%)
Elevated carboxyhemoglobin	4 (8.5%)
Simple medical intervention status	
Manageable with simple medical intervention	37 (78.7%)
Not manageable with simple medical intervention	9 (19.1%)
Unspecified	1 (2.1%)

Table 1. General demographic, clinical, and medicolegal characteristics of the cases

Variable	Total (n=47)
Life-threatening condition	
Absent	42 (89.4%)
Present	4 (8.5%)
Unspecified	1 (2.1%)
Hospitalization status	
Discharged after initial evaluation	37 (78.7%)
Ward admission	3 (6.4%)
Intensive care unit admission	7 (14.9%)
Operation status	
No	44 (93.6%)
Yes	3 (6.4%)

Abbreviations: SD, standard deviation; IQR, interquartile range.

DISCUSSION

In this retrospective series, most inhalational exposure cases involved in the forensic process had a relatively mild clinical presentation; however, a clinically meaningful subgroup required hospital admission, including intensive care unit follow-up in selected cases. This finding is consistent with the well-recognized heterogeneity of inhalation injury. Contemporary reviews emphasize that inhalational exposure does not represent a single clinical entity, but rather a broad spectrum ranging from transient mucosal irritation to airway compromise, toxic pneumonitis, and systemic poisoning. Accordingly, similar exposure histories may lead to markedly different clinical and medicolegal outcomes depending on the context, intensity, and composition of exposure (1,2,11).

One of the main findings of our study was the significant difference in age distribution according to event type. The home-accident group was notably younger, whereas the occupational-accident group had the highest median age. This pattern is clinically plausible. Domestic exposures may involve children and adolescents in enclosed household environments, whereas occupational exposures more commonly affect working-age adults and may occur under conditions of higher concentration, mixed-agent exposure, or prolonged contact. In this context, carbon monoxide and other inhalational toxic exposures remain particularly important, as they may occur in both domestic and occupational settings and may initially present with nonspecific symptoms despite potentially serious systemic consequences (12,13).

Hospitalization status also differed significantly according to event type. All interpersonal/law enforcement-related cases in our series were discharged after initial evaluation, whereas intensive care unit admission was more frequent in occupational accidents. Although this finding should be interpreted cautiously given the limited sample size, it indicates that more intensive clinical management was required in some occupational exposure cases. This interpretation is in line with the literature

indicating that more severe inhalation-related outcomes are particularly associated with smoke exposure, mixed toxic environments, and clinically complex airway injury (1,11). In addition, recent case-based evidence on occupational exposure to acid mists has shown that severe chemical pneumonitis, hypoxemia, radiologic abnormalities, and even life-threatening respiratory compromise may occur after workplace inhalation incidents (17).

Laboratory assessment differed significantly according to event type. Laboratory testing was not performed in most interpersonal/law enforcement-related cases, whereas normal and abnormal laboratory findings were documented more frequently in occupational and home-accident cases. Although the small sample size limits detailed subgroup interpretation, this pattern remains clinically meaningful. In smoke inhalation and toxic/asphyxiant exposure, laboratory evaluation may reveal oxygenation impairment, carboxyhemoglobin elevation, metabolic disturbances, or other indicators of systemic toxicity. Recent publications on carbon monoxide poisoning also underline that clinically important organ injury, including cardiac involvement, may occur even when the initial presentation is not dramatic, supporting careful evaluation of selected inhalation cases presenting through emergency pathways (12,13). A similar pattern was observed for radiological assessment, which was more frequently performed in non-pepper-spray exposure groups.

The interpersonal/law enforcement-related group in our cohort consisted entirely of pepper spray exposures. All of these patients were discharged after initial evaluation, and none required surgical intervention. This pattern is consistent with the generally self-limited ocular, cutaneous, and respiratory effects reported after pepper spray and other riot-control-agent exposures (5,6,14-16). However, the absence of hospitalization or surgery in this subgroup should not be interpreted as evidence that pepper spray exposure is uniformly clinically insignificant. Previous studies have shown that pepper spray exposure may still cause dyspnea, chest tightness, cough, and ocular injury, while tear-gas exposure has been associated with increased respiratory emergencies in vulnerable populations (14-16). Therefore, the findings observed in our pepper spray subgroup should be interpreted as characteristics of this case series rather than as evidence of universally mild clinical effects.

In our study, clinical management and selected clinical findings differed according to exposure pattern. Pepper spray exposures were characterized predominantly by discharge after initial evaluation and absence of surgical intervention, whereas smoke/explosion-related exposures more frequently involved hospitalization and surgery. However, because of the small number of cases and the overlap between exposure pattern and event context, these findings should be interpreted descriptively rather than as evidence of an independent association with clinical severity (1-4,11,12).

From a medicolegal perspective, inhalational exposure cases should not be interpreted solely on the basis of respiratory symptoms. Event type, accompanying injury, hospitalization, life-threatening condition, and the need for medical intervention may all contribute to the forensic assessment. In the present study, simple medical intervention status and life-threatening condition were evaluated according to the 2019 Turkish guideline for the assessment of injury offenses under the Turkish Penal Code (20). This is particularly relevant in poisoning-related cases, in which toxicological, neurological, cardiovascular, metabolic, and respiratory findings may influence the determination of life-threatening injury. Previous studies have also shown that incomplete or inaccurate medicolegal documentation may affect legal proceedings and patient rights, underscoring the need for careful and standardized

reporting (18,19).

Overall, our findings indicate that inhalational exposure cases involved in the forensic process constitute a clinically and medicolegally heterogeneous group. Clinical management and selected findings varied according to both event type and exposure pattern. Pepper spray cases were characterized predominantly by discharge after initial evaluation, whereas smoke/explosion-related exposures more frequently involved hospitalization and surgical intervention. However, these patterns should be interpreted cautiously because of the limited sample size and the substantial overlap between event type and exposure pattern. In daily practice, assessment should therefore consider the exposed agent, event context, age group, accompanying injury, objective clinical findings, and need for hospital-based care. Larger multicenter studies with standardized data collection are needed to clarify these relationships (11-19).

Limitations

This study has several limitations. First, it was a retrospective single-center study with a limited sample size, which restricts the generalizability of the findings. Second, the analysis was based on existing forensic and medical records; therefore, clinical documentation, laboratory testing, and radiological assessment were not standardized across all cases. In particular, the absence of a laboratory or radiological investigation in some cases reflects routine clinical practice rather than a confirmed normal finding. Third, information regarding exposure conditions, including enclosed-space exposure and exact exposure intensity or duration, was not consistently documented and could not be systematically analyzed. Fourth, event type and exposure pattern substantially overlapped in this series, limiting assessment of their independent contributions to the observed clinical findings. Finally, this cohort included only inhalational exposure cases that entered the forensic medical process and therefore does not represent the full spectrum of inhalational exposures encountered in general emergency or critical care practice. Despite these limitations, the study provides a real-world overview of the clinical and medicolegal characteristics of inhalational exposure cases encountered in routine forensic practice.

CONCLUSION

Inhalational exposure cases involved in the forensic process represent a clinically and medicolegally heterogeneous group. Although most cases in this series were discharged after initial evaluation, a subset required hospital admission, including intensive care unit follow-up. Clinical management and selected findings varied according to both event type and exposure pattern. Pepper spray exposures were predominantly managed without hospitalization, whereas smoke/explosion-related exposures more frequently involved hospital admission and surgical intervention. However, these patterns should be interpreted cautiously because of the limited sample size and the overlap between event type and exposure pattern. Clinical and medicolegal evaluation should therefore consider the exposed agent, event context, accompanying injury, objective clinical findings, and need for hospital-based care. Larger multicenter studies with standardized data collection are needed to further clarify these relationships.

Declarations

Conflict of Interest

The authors declare that they have no conflict of interest.

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REFERENCES

1. Walker PF, Buehner MF, Wood LA, et al. Diagnosis and management of inhalation injury: an updated review. Crit Care. 2015;19:351. doi:10.1186/s13054-015-1077-4.
2. Galeiras R. Smoke inhalation injury: a narrative review. Mediastinum. 2021;5:16. doi:10.21037/med-21-7.
3. Jones SW, Williams FN, Cairns BA, Cartotto R. Inhalation injury: pathophysiology, diagnosis, and treatment. Clin Plast Surg. 2017;44(3):505-511. doi:10.1016/j.cps.2017.02.009.
4. Anseeuw K, Delvau N, Burillo-Putze G, et al. Cyanide poisoning by fire smoke inhalation: a European expert consensus. Eur J Emerg Med. 2013;20(1):2-9. doi:10.1097/MEJ.0b013e328357170b.
5. Haar RJ, Iacopino V, Ranadive N, Dandu M, Weiser SD. Health impacts of chemical irritants used for crowd control: a systematic review of the injuries and deaths caused by tear gas and pepper spray. BMC Public Health. 2017;17(1):831. doi:10.1186/s12889-017-4814-6.
6. Forrester MB, Holloway C. Characteristics of pepper spray-related injuries reported to the National Electronic Injury Surveillance System during 2000-2020. Clin Toxicol (Phila). 2022;60(3):348-355. doi:10.1080/15563650.2021.1966028.
7. Kearney T, Hiatt P, Birdsall E, Smollin C. Pepper spray injury severity: ten-year case experience of a poison control system. Prehosp Emerg Care. 2014;18(3):381-386. doi:10.3109/10903127.2014.891063.
8. Tanizaki S. Assessing inhalation injury in the emergency room. Open Access Emerg Med. 2015;7:31-37. doi:10.2147/OAEM.S74580.
9. Dyamenahalli K, Garg G, Shupp JW, et al. Inhalation injury: unmet clinical needs and future research. J Burn Care Res. 2019;40(5):570-584. doi:10.1093/jbcr/irz055.
10. Reid A, Ha JF. Inhalational injury and the larynx: a review. Burns. 2019;45(6):1266-1274. doi:10.1016/j.burns.2018.10.025.
11. Giurgiu RA, Bordeanu-Diaconescu EM, Grosu-Bularda A, et al. Comprehensive review of clinical presentation, treatment, and prognostic factors of airway burns. J Med Life. 2025;18(5):405-410. doi:10.25122/jml-2025-0081.
12. Savioli G, Gri N, Ceresa IF, et al. Carbon monoxide poisoning: from occupational health to emergency medicine. J Clin Med. 2024;13(9):2466. doi:10.3390/jcm13092466.
13. Cho DH, Thom SR, Son JW, et al. Practical recommendations for the evaluation and management of cardiac injury due to carbon monoxide poisoning. JACC Heart Fail. 2024;12(8):1343-1352. doi:10.1016/j.jchf.2024.01.001.
14. Huerta PA, Albornoz AM, Abufhele M, et al. Tear gas exposure and its association with respiratory emergencies in infants and older adults during the social uprising of 2019 in Chile: an observational, longitudinal, repeated measures study. BMJ Open. 2023;13(6):e067548. doi:10.1136/bmjopen-2022-067548.
15. Yeung MF, Tang WY. Clinicopathological effects of pepper (oleoresin capsicum) spray. Hong Kong Med J. 2015;21(6):542-552. doi:10.12809/hkmj154691.
16. Schep LJ, Slaughter RJ, McBride DI. Riot control agents: the tear gases CN, CS and OC-a medical review. J R Army Med Corps. 2015;161(2):94-99. doi:10.1136/jramc-2013-000165.
17. Zhang T, He X, Wang C, et al. Case report: mixed hydrofluoric and nitric acid mist inhalation poisoning. Front Med (Lausanne). 2024;11:1342212. doi:10.3389/fmed.2024.1342212.
18. Madadin M, Alqarzaie AA, Alzahrani RS, et al. Characteristics of medico-legal cases and errors in medico-legal reports at a teaching hospital in Saudi Arabia. Open Access Emerg Med. 2021;13:521-526. doi:10.2147/OAEM.S341893.
19. Aktas N, Gulacti U, Lok U, et al. Characteristics of the traumatic forensic cases admitted to emergency department and errors in the forensic report writing. Bull Emerg Trauma. 2018;6(1):64-70. doi:10.29252/beat-060110.
20. Türk Ceza Kanunu'nda Tanımlanan Yaralama Suçlarının Adli Tıp Açısından Değerlendirilmesi Rehberi. Adli Tıp Kurumu Başkanlığı; 2019.