

Health effects of tear gas exposure in children, infants, and fetuses

KL Hon¹ *, MB, BS, MD, Karen KY Leung¹, MB, BS, MRCPCH, Alexander KC Leung², FRCP (UK), FRCPCH

¹ Department of Paediatrics and Adolescent Medicine, The Hong Kong Children's Hospital, Hong Kong

² Department of Pediatrics, The University of Calgary and Alberta Children's Hospital, Calgary, Canada

* Corresponding author: ehon@hotmail.com

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In summer 2019, during demonstrations in Hong Kong, tear gas was used as a crowd control measure, and children were among those reported to be exposed.¹ There have been reports in the literature on the effects of tear gas on individuals.² This commentary discusses the effects of and long-term outcomes after tear gas exposure, especially on children, and provides information for physicians and caregivers responsible for such children.

Although different chemical agents have been used as tear gas, *o*-chlorobenzylidene malononitrile (known as CS) is the most commonly used.³

Acute effects of tear gas exposure

The health effect of tear gas is related to the concentration and duration of exposure. Most life-threatening toxic effects post-exposure to tear gas are from cases after exposure in a confined space for a prolonged period of time.³ Symptoms of tear gas exposure usually occur within 20 to 60 s and include irritation to the eyes, photophobia, lacrimation, conjunctival injection, blepharospasm, conjunctivitis, periorbital oedema, headache, dizziness, cough, shortness of breath, bronchospasm, chest pain, haemoptysis, pulmonary oedema, and in severe cases, asphyxia, syncope, and even death.⁴

The most common complaints after tear gas exposure include skin burns and symptoms resulting from an inflamed throat.⁵ The burns are typically categorised as minor superficial or partial-thickness skin burn injuries.⁶ Ophthalmic effects have also been reported, including blepharospasm, conjunctivitis, periorbital oedema, and corneal pathology.⁷

Respiratory symptoms are also common after tear gas exposure. Tear gas may trigger bronchospasm and asthma attack in children and young individuals with asthma and obstructive airway disease or children with bronchopulmonary disease.² A Korean study on tear gas exposure found that patients with asthma and chronic obstructive disease experienced deterioration in lung function and required a lengthened hospital stay.⁸ The clinical effects of respiratory symptoms may vary from immediate to 2 weeks.³

Fetuses, infants, and children after tear gas exposure

Fetuses, infants, and children may be susceptible to chemical pollutants.⁹ There was an old case report in 1972 of a 4-month-old infant who developed pneumonitis following a prolonged exposure of tear gas.¹⁰ There are limited data on the effects of acute exposure to tear gas during pregnancy. The National Teratology Information Service collected outcome data on pregnant women who were exposed to tear gas and concluded that in the absence of severe maternal toxicity, increased risk of fetal toxicity is unlikely.¹¹ To the best of our knowledge, there are no reports in the literature on the effect of tear gas on breastfeeding.

Environmental exposures and biological considerations of children in relation to chemical pollutants are necessary. The American Academy of Pediatrics issued statement in response to tear gas being used against children at the United States Southern border in November and remarks that the use of tear gas on children threatens their short- and long-term health, and states that children are uniquely vulnerable to physiological effects of toxic chemical agents.¹² Compared with an adult, a child's smaller size, more frequent breaths, and limited cardiovascular stress response magnifies the harm of toxic agents such as tear gas.¹²

Long-term outcomes after tear gas exposure

There are few reports in the literature on the medium- to long-term outcomes after tear gas exposure. One study assessed the long-term respiratory effects in patients with a history of frequent exposure to tear gas concluded that the rates of respiratory complaints were higher in those exposed to tear gas.¹³ Although tear gas is potentially genotoxic, as it can alkylate sulfhydryl groups, and possibly DNA, the genetic effect has not been well studied.⁸ There is no evidence that a healthy individual will experience long-term health effects from open-air exposure to tear gas.¹⁴ To the best of our knowledge, there are no

reports on the long-term health effects of tear gas in children.

Treatment for tear gas exposure

No specific antidote is available to tear gas exposure.^{4,7,15,16} Individuals exposed to tear gas should leave the scene immediately.⁴ Skin reactions may be reduced by removing contaminated clothing and contact lenses.^{7,15} The eye should be irrigated with water or saline.^{4,7,15-18} Bathing and washing the body vigorously with soap and water can remove particles that adhered to the skin while clothes, shoes, and accessories that have come into contact with vapours must be washed well since all untreated particles can remain active for up to a week.¹⁵ Anticholinergics such as antihistamines may reduce lacrimation and decrease salivation. Oral analgesics may help relieve eye pain.¹⁵

Conclusions

Although no mortality or long-term morbidity have been reported in children, prevention is better than treatment. Parents and carers should be advised to avoid taking children to locations where tear gas may be deployed. The effects of tear gas can be significant to children. Surveillance programmes can be considered by the health authorities to monitor the long-term health consequences to children after tear gas exposure.

Author contributions

All authors contributed to the concept or design of the study, acquisition of the data, analysis or interpretation of the data, drafting of the manuscript, and critical revision of the manuscript for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

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