Faculty of Forensic and Legal Medicine

Recommendations

Irritant Sprays: Clinical Effects and Management

Recommendations for Healthcare Professionals

(Forensic Physicians, Custody Nurses and Paramedics)

Introduction

CS & PAVA irritant spray effects and management

Irritant sprays augment the range of 'less-lethal' tactical options available to police officers confronted by potentially aggressive or violent individuals or those with acute behavioural disturbance.

The terminology for CS and PAVA sprays used by police officers has been changed recently in the UK as they are not 'incapacitants' in the way that word is defined in the Chemical Weapon Convention; they are 'Riot Control Agents' (i.e. effects can be reversed without medical intervention). The police have been advised (by the Home Office Centre for Applied Science and Technology) to adopt the term 'irritant' rather than 'incapacitant' for their CS and PAVA Sprays. This terminology will be used in these recommendations.

The agents currently used by police forces in the UK are:

- **CS**
- **PAVA**

Both are contained in a suitable solvent as described in the Home Office Standard for Police Chemical Irritant Sprays.

They are intended to be used to spray the face of a person at a distance of up to 3-4 metres, delivering the active chemical to the eyes, nose and mouth. This causes irritation to the eyes, upper respiratory tract and skin.

In most cases the symptoms and signs are short-lived, resolving over 15 to 30 minutes and requiring little or no medical intervention – although some individuals may experience effects for 2.5 hours or more. Longer exposure or exposure in confined spaces may result in enhanced or prolonged effects.

The broad principles of effect, treatment and management are the same for both CS spray and PAVA spray. No reported clinical studies have compared the nature and incidence of effects from them.

CS Irritant Spray

Chemical name	**CS** O-chlorbenzylidene malonitrile, 5% solution
Solvent	Methyl Isobutyl Ketone (MIBK)
Propellant	Nitrogen for hand held spray
Formulation used	Liquid Spray

CS is a solid at room temperature but is dissolved in an organic solvent to be used as a liquid aerosol. The solvent evaporates leaving the CS particles to give their effects.

PAVA Irritant Spray

Chemical name	Pelargonic acid vanillylamide, 0.3% solution
Solvent	Monopropylene glycol, ethanol, water
Propellant	Nitrogen
Formulation used	Liquid spray

PAVA is a synthetic variant of capsaicin (the active ingredient of natural pepper).

CS and PAVA fail to affect about 10% of people sprayed. The reasons for this are varied and may include intoxication with other drugs or alcohol;

mental health issues; or other acute behavioural disturbance. Agitation may impede initial decontamination and increase the risks of secondary contamination of self or others.

General Advice

In the majority of cases the main effects pass off after 15 to 30 minutes and medical intervention is not required, although skin and eye signs and symptoms may persist beyond 2.5 hours.

It is very important to reassure the affected individual.

Restraint in the prone position must be avoided after exposure. If restrained, breathing must be monitored constantly.

Any effects that last for > 6 hours should generally be referred for relevant specialist assessment.

- The most important action is to stop continued exposure by removal of the affected individual from the contaminated environment to a well-ventilated area, preferably with a free flow of air (enhanced by the use of electric fans), and careful removal of contaminated clothing (which should be placed in sealed plastic bags).
- Water should **not** be used at an early stage to attempt to remove residue as it will exacerbate symptoms or cause symptom relapse.
- Avoid rubbing the eyes. If an individual cannot open their eyes after 15-20 minutes, then copious amounts of cool tap water should be used to flush remaining irritant from the skin of the face (sterile normal saline should be used to treat eyes – see below). Contact lenses should be removed as soon as possible. Depending on type they may not be re-usable. Under **no** circumstances should warm water be used to irrigate as this can reactivate the irritants.
- Those dealing with the contaminated individual should wear gloves and eye protection to avoid cross contamination.
- Care should be taken to avoid CS entering air conditioning or ventilation systems.
- Each individual should be fully examined by an appropriately skilled and trained healthcare professional, with particular reference to eyes, oral and nasal cavity, respiratory system and skin.
- Subjects with any signs or symptoms that do not resolve after 6 hours should be referred for hospital assessment.
- Persons sprayed or contaminated with CS or PAVA should be advised to contact their general practitioner or attend their emergency department with a copy of these guidelines if problems develop once they have been released from custody, or complete resolution of signs and symptoms does not occur
- Normal machine washing will decontaminate clothing but it may take several washes to be fully successful.

Specific Effects and Management

Determination on whether specialist referral is required will generally be based on the clinical findings of the medical assessment and not on the irritant agent used.

Eyes

Clinical Effects – expected duration of most intense effects

- lachrymation (tears) (<15 mins);
- pain (<30 mins);
- blepharospasm (eyelids closed) (<30 mins);
- conjunctival erythema (redness) (<30 mins);
- reduced visual acuity (blurred vision) (<30 mins);
- photophobia (sensitivity to light) (<60 mins);
- periorbital oedema (swelling around the eye);
- damage to the ocular surface from the direct trauma of a high-pressure jet;
- iritis may develop as a non-specific response
- conjunctivitis;
- corneal abrasions due to rubbing the eyes.

Management

- air could be blown with a fan directly onto the eyes to encourage evaporation
- or exposure to external air/wind;
- if eye symptoms persist for more than one hour irrigate eyes with sterile normal saline solution (this may temporarily exacerbate symptoms as the vapour passes into solution) prior to hospital referral;
- contact lenses should be removed and either discarded (soft) or cleaned with 10 washes and soaks. It may take several weeks for the eye to settle down enough to allow a return to contact lens wear (advice may be appropriately sought from an optometrist);
- prophylactic antibiotics have no role;
- if eye symptoms do not resolve after 6 hours or corneal abrasion is identified refer for formal ophthalmic assessment.

Mouth

Clinical Effects

- stinging or burning sensation;
- possible nausea and vomiting (rare).

Management

- nil specific – symptomatic, based on clinical findings

Respiratory Tract

Clinical Effects

- nose discomfort, pain & rhinorrhoea (<30 mins);
- sneezing & coughing;
- sore throat;
- shortness of breath;
- bronchospasm (rare);
- laryngospasm (rare);
- tracheitis;
- bronchitis (rare);
- pulmonary oedema may develop 12 to 24 hours after excessive exposure (rare);
- NB patients with pre-existing respiratory disease, such as asthma or bronchitis, are more at risk of severe effects.

Management

- The majority of respiratory tract symptoms and signs (e.g. dyspnoea, chest tightness and irregular breathing) should settle within 15 minutes of the exposure;
- if there is evidence of bronchospasm that does not respond to bronchodilator refer to hospital for assessment and treatment. Humidified oxygen may provide some relief;
- persistent respiratory symptoms necessitate review by a respiratory physician

Skin

Clinical Effects

- burning sensation & erythema (<24 hrs);
- chemical burns, blistering;
- allergic contact dermatitis (rare - but if in law enforcement personnel regularly exposed to irritant spray may require changes in work practice – referral to Occupational Health teams should be made);
- leukoderma (rare);
- initiation or exacerbation of seborrhoeic dermatitis (rare);
- aggravation of rosacea (rare).

Management

- exposure to air and fan;
- exposure to fresh air will normally result in a significant recovery within 15 – 20 minutes;
- if reactions do persist beyond this period then copious amounts of cool tap water should be used to flush remaining irritant from the face and skin;
- under no circumstances should warm water be used as this can reactivate irritants;
- treat chemical burns as thermal burns;

- topical steroids can be used for contact dermatitis;
- delayed skin irritation (due to MIBK), occurring 8 to 16 hours after exposure, is seen in a significant number; these symptoms can take up to one week to resolve.
- persistence of new skin conditions or aggravation of chronic conditions beyond 48 hours should be assessed by the person's GP and referral to a dermatologist may be required.

Cardiovascular Effects

Clinical Effects

- pre-existing cardiac problems can be worsened and hypertension exacerbated after exposure. For example, angina attacks may develop.

Management

- symptomatic treatment e.g. glyceryl trinitrate;
- refer to hospital if any concerns at examination (e.g. persistent tachycardia, arrhythmias, hypertension, hypotension).

Other

Psychological Effects

- In one study, one quarter of those exposed to CS spray were diagnosed with Post Traumatic Stress Disorder; a past psychiatric history and a more external locus of control was associated with post-traumatic morbidity.

Management

- Consideration should be given to early psychological intervention if the individual is perceived to be at risk.

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