

CROWD CONTROL AGENTS

INTRODUCTION

The most common crowd control agents ('CCA') are:-

- o-chlorobenzylidene malononitrile (CS)
- l-chloroacetophenone (CN, 'Mace')
- dibenzoxazepine (CR)
- oleoresin capsicum (OC, 'Pepper Spray')
- pelargonic acid vallinylamide (PAVA)

N.B: CS, CN and CR are code names and are not derived from the chemical names or formulae.

Some of these chemicals are crystalline solids in their natural state, but are used in solution as aerosols for easy and relatively safe projection and dispersal. Others are viscous resins.

SIDE EFFECTS

These chemicals are irritants to the skin, eyes and upper respiratory tract. Their irritant effect stimulates tear secretion, hence the name "tear gas". In the majority of cases effects are short-lived and self-limiting. Severe cases are only likely to occur following exposure to high concentrations in confined spaces. The agents differ in their relative side effects:

- **dibenzoxazepine (CR)**
The most potent lacrimator with the least systemic effects.
- **l-chloroacetophenone (CN)**
The most toxic of these agents.
Deaths from pulmonary injury and/or asphyxia have been reported.
Constituent of Mace.
- **o-chlorobenzylidene malononitrile (CS)**
Ten times more potent a lacrimator than CN, but less toxic.

CURRENT USAGE

Most Police Forces in the UK use CS Spray [with methyl-isobutyl ketone (MIBK) as the solvent and nitrogen as the propellant]. Some forces are now using PAVA [in a solvent of ethanol and water with a nitrogen propellant].

CLINICAL EFFECTS OF CN, CR AND CS SPRAY

- **Onset And Duration:**
Virtually immediate onset, effects usually settle within 15-30 minutes after removal from exposure. Occasionally ocular and mucous membrane effects can last for up to 24 hours.
- **Eye:**
Blinking, lacrimation, pain, blepharospasm, conjunctival erythema, periorbital oedema and damage to the ocular surface from the high-pressure jet or rubbing the eyes. People wearing contact lenses may experience greater discomfort.
- **Nose:**
Discomfort or burning sensation, pain and rhinorrhoea.
- **Mouth:**
Stinging or burning sensation, salivation, possibly nausea and vomiting.
- **Respiratory Tract:**
Sore throat, coughing, sneezing, increased secretions and a sensation of shortness of breath. Bronchospasm and laryngospasm may occur. Pulmonary oedema may occur 12-24 hours later following excessive exposure. Patients with pre-existing respiratory disease (e.g. asthma, bronchitis) may be more at risk of severe effects.
- **Skin:**
Burning sensation and erythema, which usually settles within 24 hours. Prolonged exposure, particularly when clothing is wet, can produce chemical burns. Skin exposed to CR may become painful on contact with water up to 48 hours later. CN is a skin sensitiser and can produce allergic contact dermatitis (pruritus, weeping, papulovesicular rash) within 72 of exposure. Allergic contact dermatitis has also been reported following exposure to CS.

TREATMENT OF EXPOSURE TO CN, CR AND CS SPRAY

In the majority of cases effects resolve spontaneously within 15-30 minutes after cessation of exposure and medical treatment is usually not required. Reassurance is essential. The most important first line treatment is removal from exposure and removal of contaminated clothing (dry if possible), which should be sealed in plastic bags (preferably double bagged).

Medical personnel should wear gloves. Casualties should be placed in a well ventilated area, preferably where there is a free flow of air to ensure rapid dispersal of the spray.

Usually tear secretions are sufficient to remove the chemical from the eye, but symptomatic relief may also be achieved by blowing dry air onto the eyes with a fan. Where ocular effects persist eye irrigation should be undertaken using isotonic saline (sterile water may be used in emergencies but it may cause transient corneal oedema following prolonged irrigation). Ophthalmological referral is indicated for patients with severe ocular effects. People who wear contact lenses should be permitted to remove them at the earliest opportunity. 'Rigid' or 'hard' contact lenses may be reused after thorough cleaning, 'non-rigid' or 'soft' contact lenses should not be reused.

The skin should be washed with soap and copious amounts of water if necessary, paying particular attention to skin folds. Further treatment is unlikely to be required.

Showering may release particles trapped in the hair causing transient further irritation. Any chemical burns should be treated as thermal burns. Topical steroids may be used for contact dermatitis.

Patients with persistent respiratory symptoms should be admitted to hospital for observation. Humidified oxygen may provide symptomatic relief.

Clothing may be decontaminated by washing in a conventional washing machine with a normal powder or liquid. The clothing should be washed several times before wearing to ensure all the chemical is removed.

CLINICAL EFFECTS OF PAVA SPRAY

- **Onset and Duration:**
Virtually immediate onset, effects usually settle within 15-30 minutes after removal from exposure. Occasionally ocular and mucous membrane effects can last for up to 24 hours.
- **Eye:**
Blinking, lacrimation, pain, blepharospasm, conjunctival erythema, periorbital oedema and damage to the ocular surface from the high pressure jet or rubbing the eyes. People wearing contact lenses may experience greater discomfort.
- **Nose:**
Discomfort or burning sensation, pain and rhinorrhoea.

- **Mouth:**
Stinging or burning sensation, salivation, possibly nausea and vomiting.
- **Respiratory Tract:**
Sore throat, tight chest, coughing, sneezing and increased secretions.
Bronchospasm may occur. Patients with pre-existing respiratory disease (e.g. asthma, bronchitis) may be more at risk of severe effects.
- **Skin:**
Burning sensation and erythema, which usually settles within 24 hours.

TREATMENT OF EXPOSURE TO PAVA SPRAY

In the majority of cases effects resolve spontaneously within 15-45 minutes after cessation of exposure and medical treatment is usually not required. Reassurance is essential. The most important first line treatment is removal from exposure and removal of contaminated clothing (dry if possible), which should be sealed in plastic bags.

Medical personnel should wear gloves. Casualties should be placed in a well ventilated area, preferably where there is a free flow of air to ensure rapid dispersal of the spray.

Usually tear secretions are sufficient to remove the chemical from the eye. Where ocular effects persist eye irrigation should be undertaken using isotonic saline (sterile water may be used in emergencies but it may cause transient corneal oedema following prolonged irrigation). Ophthalmological referral is indicated for patients with severe ocular effects. People who wear contact lenses should be permitted to remove them at the earliest opportunity. 'Rigid' or 'hard' contact lenses may be reused after thorough cleaning, 'non-rigid' or 'soft' contact lenses should not be reused.

The skin should be washed with copious amounts of cool (not warm) water if necessary. Further treatment is unlikely to be required.

Patients with persistent breathing difficulties lasting more than 15 to 45 minutes should be referred to hospital for assessment and observation. Humidified oxygen may provide symptomatic relief. Particular consideration should be given to patients with existing pulmonary or cardiac disorders and normal clinical guidelines followed. Hypertension can be exacerbated.

Clothing may be decontaminated by washing in a conventional washing machine with a normal powder or liquid. The clothing should be washed several times before wearing to ensure all the chemical is removed.

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As there is less experience in the UK with PAVA compared to CS, members of the AFP and any other doctors working in the UK are requested to inform the Honorary Secretary of the AFP (via the AFP website www.afpweb.org.uk) of any injuries or side effects from the use of PAVA which are encountered in clinical work.

Updated (April 2006) by Dr Debbi Rogers and Dr Ian F Wall on behalf of the Education and Research Committee, Association of Forensic Physicians ©.